PackML 3.0-based Programming

Allen-Bradley

Quick Start

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.literature.rockwellautomation.com) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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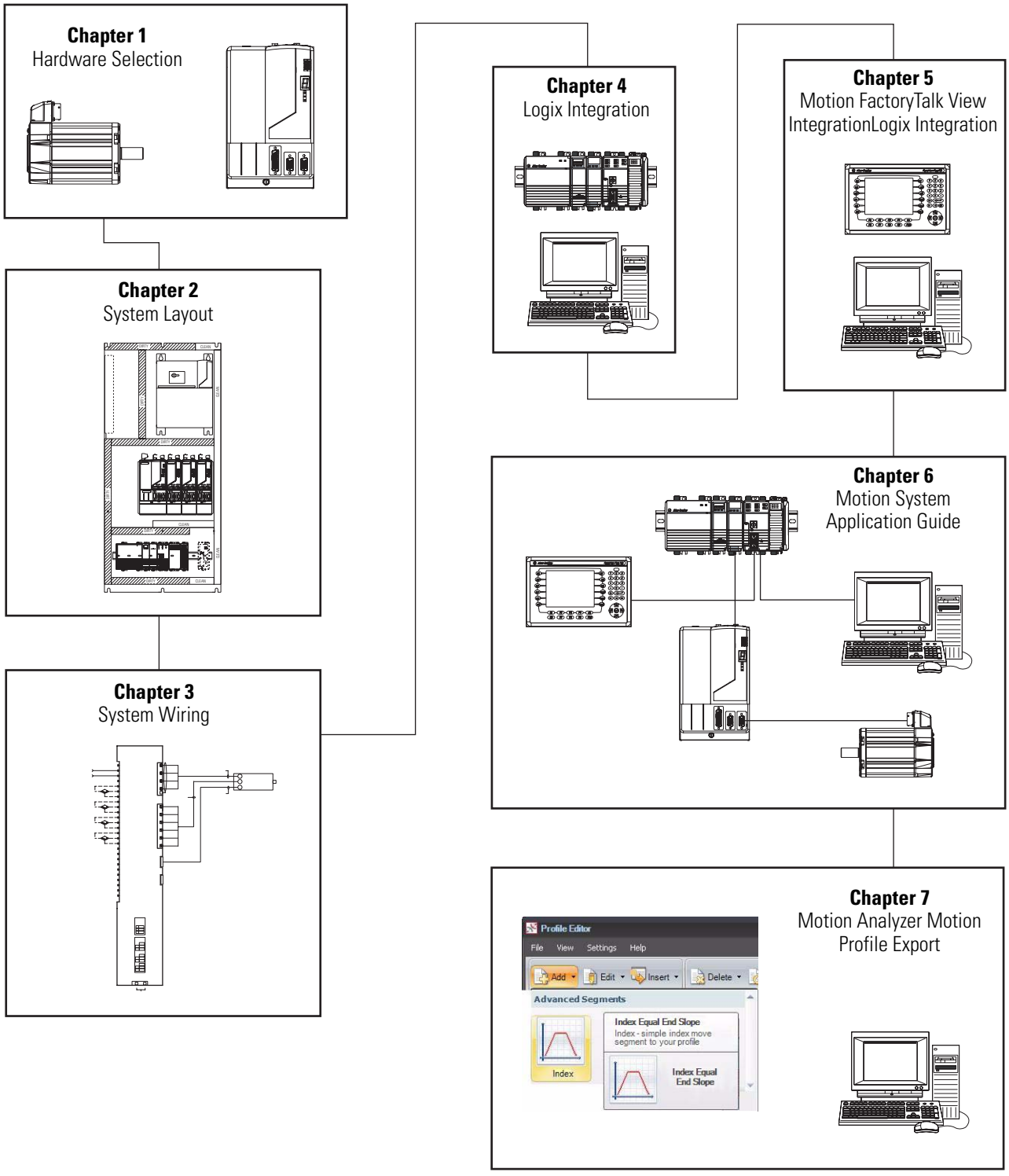
Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
SHOCK HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

Where to Start

Follow the path below to complete your Kinetix Integrated Motion application.



Notes:

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Introduction

This quick start provides examples of using a Logix controller to connect to multiple devices (servo drives, motors, and HMI) over the EtherNet/IP network in a Kinetix Integrated Motion application. These examples were designed to get devices installed and communicating with each other in the simplest way possible. The programming involved is not complex, and offers easy solutions to verify that devices are communicating properly.

To assist in the design and installation of your Kinetix Integrated Motion system, application files and other information is provided on the Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004. The DVD provides CAD drawings for panel layout and wiring, base Logix control programs, FactoryTalk View (HMI) application files, and more. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative. With these tools and the built-in best-practices design, the system designer is free to focus on the design of their machine control and not on design overhead tasks.

You can also download these same supporting files from the Rockwell Automation Integrated Architecture Tools website, http://www.ab.com/go/iatools on the Beyond Getting Started tab.

IMPORTANT Before using this quick start and the contents of the Kinetix Accelerator Toolkit DVD, read the Terms and Conditions READ ME.pdf on the DVD.

The beginning of each chapter contains the following information. Read these sections carefully before beginning work in each chapter.

- **Before You Begin** - This section lists the steps that must be completed and decisions that must be made before starting that chapter. The chapters in this quick start do not have to be completed in the order in which they appear, but this section defines the minimum amount of preparation required before completing the current chapter.
- **What You Need** - This section lists the tools that are required to complete the steps in the current chapter. This includes, but is not limited to, hardware and software.
- **Follow These Steps** - This illustrates the steps in the current chapter and identifies which steps are required to complete the examples using specific networks.

Required Software

To complete this quick start, the following software is required.

Rockwell Automation Software	Cat. No.	Minimum Version
RSLogix 5000	9324-RLD300ENE	17
FactoryTalk View Studio for Machine Edition (includes RSLinx Enterprise and RSLinx Classic)	9701-VWMR030AENE	5.00
Motion Analyzer/Motion Selector	Download at http://www.rockwellautomation.com/en/e-tools	4.6
Kinetix Accelerator Toolkit DVD	IASIMP-SP004	IASIMP-SP004G-EN-C

Conventions Used in This Manual

This manual uses the following conventions.

Convention	Meaning	Example
Click	Click left mouse button once to initiate an action. (Assumes cursor is positioned on object or selection).	Click Browse.
Double-click	Click left mouse button twice in quick succession to initiate an action. (Assumes cursor is positioned on object or selection.)	Double-click the Motion Analyzer version 4.6 application file.
Right-click	Click right mouse button once. (Assumes cursor is positioned on object or selection.)	In the Explorer window, right-click I/O Configuration.
Drag and drop	Click and hold the left mouse button on an object, move the cursor to where you want to move the object, and release the mouse button.	Drag and drop the desired block into the Strategy window.
Select	Click to highlight a menu item or list choice.	In the Edit menu, select Controller Properties.
Check/uncheck	Click to select a checkbox option.	Check the Open Module Properties box.
>	Shows nested menu selections as menu name followed by menu selection.	Click File>Page Setup>Options.
Expand	Click the + to the left of a given item/folder to show its contents.	Expand the Motion category.
Enter	Used when you can type from the keyboard or choose from a list.	Enter the catalog number of the product.
Type	Used when the only option is to type from the keyboard.	Type the catalog number of the product.
Press	Press a specific button on the PanelView terminal or other component with touch-screen technology.	Press EM Manual Jog.

Hardware Selection

In this chapter you make your motion application hardware selection. You can select from the basic motion control panels or use Motion Analyzer software to size your servo drive and motor.

You can modify the basic motion control panels with up to four axes, a different PanelView Plus terminal, and other optional equipment.

Before You Begin

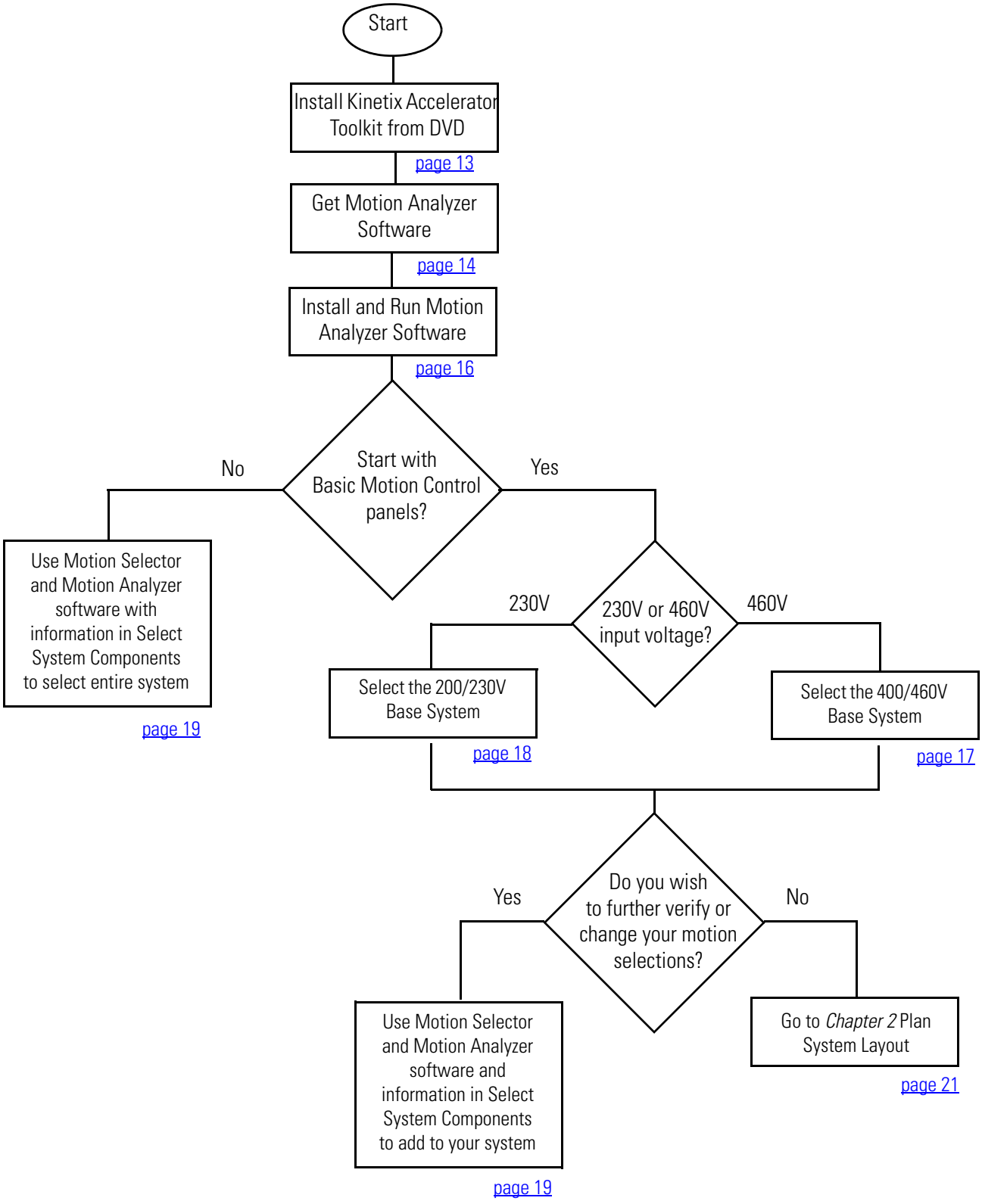
- Determine your base motion system input voltage.
  - 400/460V
  - 200/230V
- Verify that your computer meets the software requirements of Motion Analyzer, version 4.6.

What You Need

- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.
- Personal computer.
- Internet access for downloading software (optional, especially for software updates).
- Motion Analyzer software, version 4.6, available from:
  - the Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004.
  - http://www.rockwellautomation.com/en/e-tools
    (installed in this chapter.)
- Kinetix Motion Control Selection Guide, publication GMC-SG001.

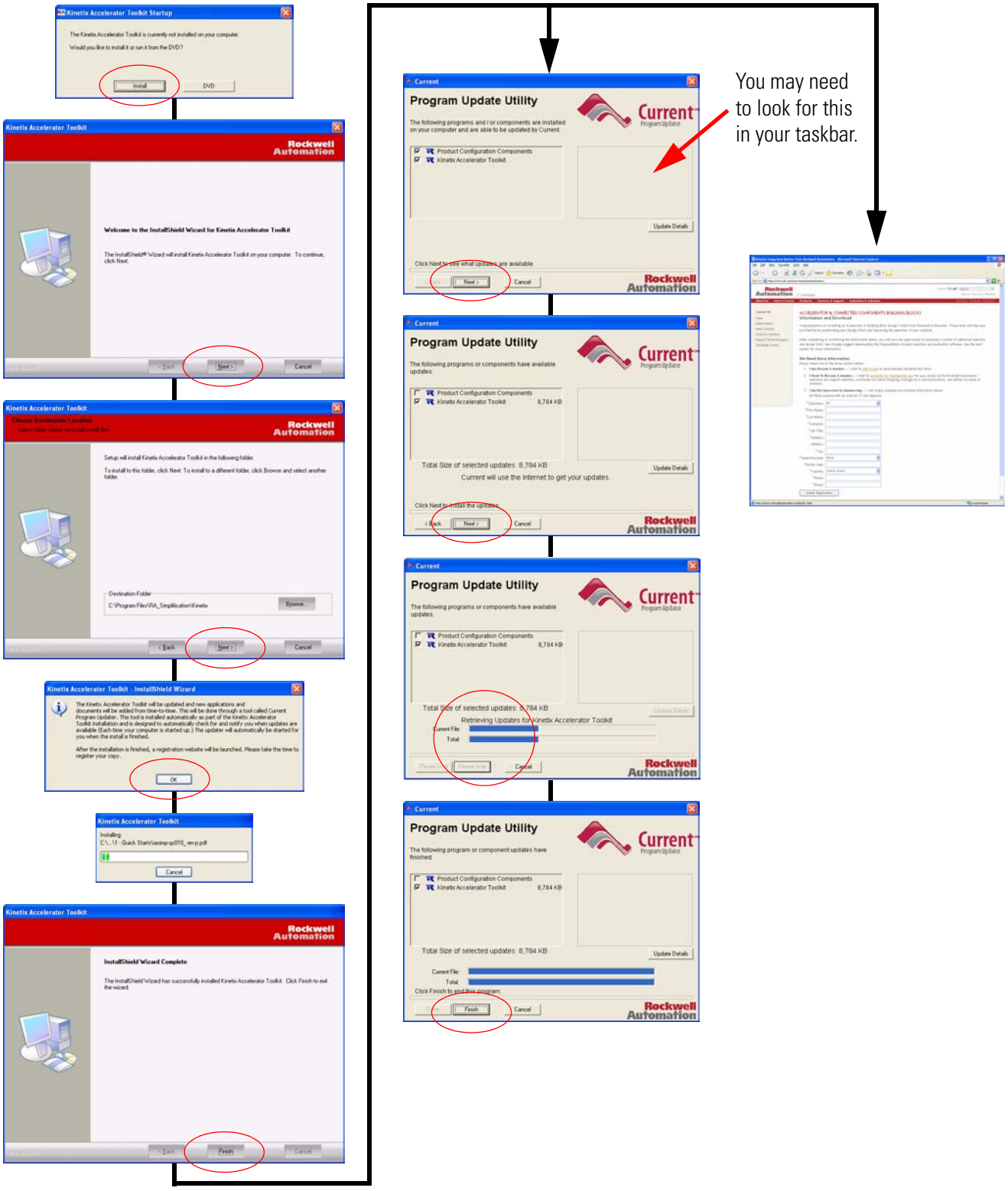
Follow These Steps

Complete the following steps to select your motion system hardware.



Install Kinetix Accelerator Toolkit from DVD

Insert the Kinetix Accelerator Toolkit DVD in your personal computer and follow these steps to install the Kinetix Accelerator Toolkit from the DVD.



Get Motion Analyzer Software

Motion Analyzer is a comprehensive motion control software tool with application analysis used for sizing your motor/drive combinations.

To prepare to install Motion Analyzer and Motion Selector software, follow the steps in either of these sections:

- *Accessing Motion Analyzer Software on the Web* below
- *Accessing Motion Analyzer Software from Kinetix Accelerator Toolkit* on page 15

Accessing Motion Analyzer Software on the Web

Follow these steps to access Motion Analyzer and Motion Selector software from the Web.

1. Open your Web browser and go to http://www.rockwellautomation.com/en/e-tools.

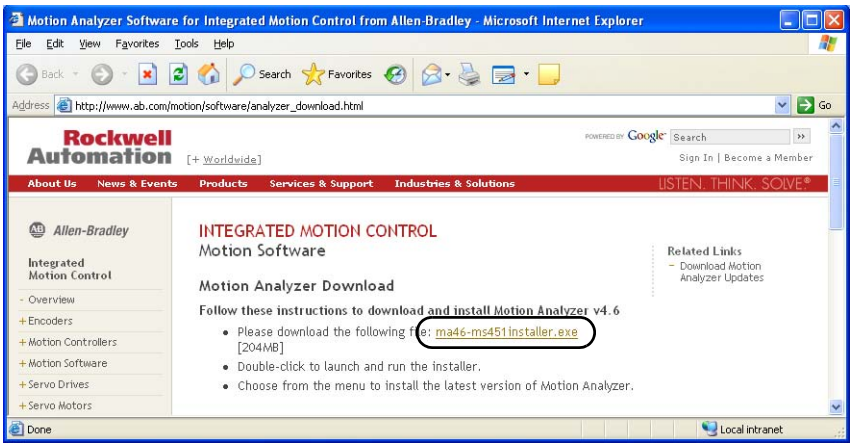
   The Configuration and Selection Tools webpage opens.

2. Click the System Configuration tab.
3. Click Motion Analyzer.
4. Click Download.

   The Motion Software webpage opens.

5. Click the Motion Analyzer download link.
6. Click Run.

   The installer prepares the files.



Accessing Motion Analyzer Software from Kinetix Accelerator Toolkit

Follow these steps to access Motion Analyzer and Motion Selector software from the Kinetix Accelerator Toolkit.

1. Choose Start > Programs > Rockwell Automation > Simplification > Kinetix Accelerator Toolkit to open the Kinetix Accelerator Toolkit software.

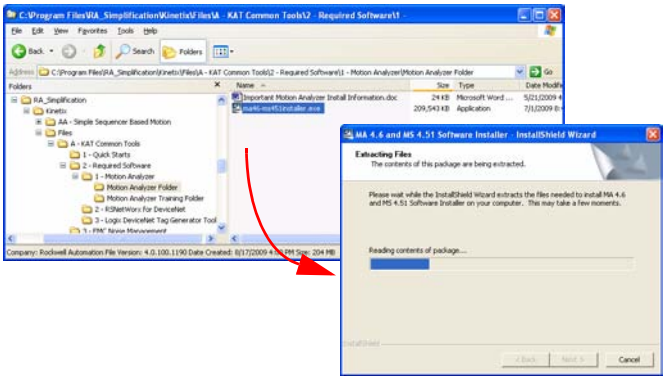
2. Click Use The KAT Development Tools.

3. Browse to the Motion Analyzer folder.

4. Open the Motion Analyzer folder.

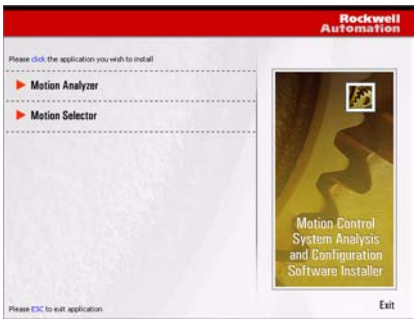
5. Double-click ma46-ms451installer.exe.

   The installer prepares the files.



Install and Run Motion Analyzer Software

1. Install both Motion Analyzer and Motion Selector software, following the on-screen instructions for each.



2. If this dialog box appears, click OK.

3. When done, click Exit.

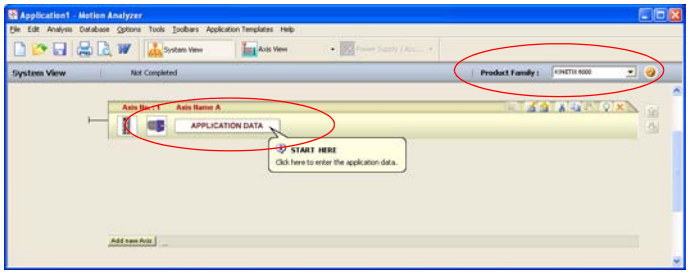
4. Choose Start > Programs > Rockwell Automation > Motion Analyzer > Motion Analyzer to start the application.

The System View dialog box opens.

5. From the Product Family pull-down menu, choose your servo drive family.

6. Click APPLICATION DATA.

7. Enter the data for your motion application.



TIP

For motor/drive performance specifications, refer to the Kinetix Motion Control Selection Guide, publication GMC-SG001.

For Motion Analyzer labs, refer to the Motion Analyzer Training Folder on the Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.

Reviewing Basic Panel Component Listings

These tables include servo drives and motors, CompactLogix controller, PanelView Plus terminal (HMI), and accessory components for 400/460V and 200/230V systems. Review the basic component listings and compare with your specific application needs.

Select the 400/460V Base System

# Used	Components		Cat. No.	Description
1	Enclosure and panel (HxWxD, approx.)		Hoffman	1219 x 609 x 304 mm (48 x 24 x 12 in.)
			Rittal	
1	Input power	Line Interface Module (LIM)	2094-BL50S	460V, 50 A
1			140U-H-RVM12R	Through-the-door disconnect
1		AC Line Filter	2090-XXLF-X330B	3-phase, 30 A
1	Kinetix 6000 Multi-axis Servo Drive System	Power Rail	2094-PRS4	4-slot, slim
1		Integrated Axis Module (IAM)	2094-BC02-M02-S	15 kW converter and 10.3 A (rms) inverter output, safe-off feature
1		Axis Module (AM)	2094-BM01-S	6.1 A (rms) inverter output, safe-off feature
2		Axis Module (AM)	2094-BMP5-S	2.8 A (rms) inverter output, safe-off feature
1	Motors	MP-Series Low Inertia	MPL-B330P-MK22AA	1.8 kW output with absolute, multi-turn feedback
1			MPL-B320P-MK22AA	1.4 kW output with absolute, multi-turn feedback
2			MPL-B1520U-VJ42AA	0.27 kW output with absolute, multi-turn feedback
2	Cables	Motor Power	2090-XXNPMP-16S03	3 m (9.8 ft), MPL-B320P and MPL-B330P
2			2090-XXNPMF-16S03	3 m (9.8 ft), MPL-B1520U
2		Motor Feedback	2090-XXNFMP-S03	3 m (9.8 ft), MPL-B320P and MPL-B330P
2			2090-XXNFMF-S03	3 m (9.8 ft), MPL-B1520U
2		SERCOS fiber-optic	2090-SCEP3-0	3.0 m (9.8 ft)
3			2090-SCEP0-1	0.1 m (5.1 in.)
1		Ethernet	2711P-CBL-EX04	Ethernet CAT5 crossover cable 4.3 m (14 ft)
4	Connector kit	Feedback	2090-K6CK-D15M	Low-profile connector kit for motor feedback
1	HMI	PanelView Plus	2711P-T6C20D	PanelView Plus 600, 24V dc, ethernet comms
1	Logix controller	CompactLogix with EtherNet/IP Configuration	1768-L43	Controller
1			1768-M04SE	SERCOS module
1			1768-ENBT	Ethernet module
1			1764-PA4	Power supply
1			1769-IQ32	32-point 24V dc input module
1			1769-OB16	16-point 24V dc sourcing output module
1			1769-ECR	End cap
1	Software	RSLogix 5000	9342-RLD300ENE	Application program software
1		FactoryTalk View ME	9701-VWMR030AENE	HMI visualization software

Select the 200/230V Base System

# Used	Components		Cat. No.	Description
1	Enclosure and panel (HxWxD, approx.)		Hoffman	1219 x 609 x 304 mm (48 x 24 x 12 in.)
			Rittal	
1	Input power	Line Interface Module (LIM)	2094-AL50S	230V, 50 A
2			140U-H-RVM12R	Through-the-door disconnect
3		AC Line Filter	2090-XXLF-X330B	3-phase, 30 A
1	Kinetix 6000 Multi-axis Servo Drive System	Power Rail	2094-PRS4	4-slot, slim
1		Integrated Axis Module (IAM)	2094-AC09-M02-S	6 kW converter and 10.6 A (rms) inverter output, safe-off feature
1		Axis Module (AM)	2094-AM01-S	6.0 A (rms) inverter output, safe-off feature
1	Kinetix 2000 Multi-axis Servo Drive System	Power Rail	2093-PRS2	2-slot
1		Integrated Axis Module (IAM)	2093-AC05-MP2	3 kW converter and 2.0 A (rms) inverter output
1		Axis Module (AM)	2093-AMP1	1.0 A (rms) inverter output
1	Motors	MP-Series Low Inertia	MPL-A320P-MK22AA	1.3 kW output with absolute, multi-turn feedback
1			MPL-A230P-VJ42AA	0.86 kW output with absolute, multi-turn feedback
2			MPL-A1530U-VJ42AA	0.39 kW output with absolute, multi-turn feedback
1	Cables	Motor Power	2090-XXNPMP-16S03	3 m (9.8 ft), MPL-A320P
3			2090-XXNPMF-16S03	3 m (9.8 ft), MPL-A1530U and MPL-A230P
1		Motor Feedback	2090-XXNFMP-S03	3 m (9.8 ft), MPL-A320P
3			2090-XXNFMF-S03	3 m (9.8 ft), MPL-A1530U and MPL-A230P
2		SERCOS fiber-optic	2090-SCEP0-1	0.1 m (5.1 in.)
1			2090-SCEP1-0	1.0 m (3.2 ft)
2			2090-SCEP3-0	3.0 m (9.8 ft)
1		Ethernet	2711P-CBL-EX04	Ethernet CAT5 crossover cable 4.3 m (14 ft)
2	Connector kit	Feedback	2090-K6CK-D15M	Low-profile kit for Kinetix 6000 motor feedback
2			2090-K2CK-D15M	Low-profile kit for Kinetix 2000 motor feedback
1	HMI	PanelView Plus	2711P-T6C20D	PanelView Plus 600, 24V dc, ethernet comms
1	Logix controller	CompactLogix with EtherNet/IP Configuration	1768-L43	Controller
1			1768-M04SE	SERCOS module
1			1768-ENBT	Ethernet module
1			1764-PA4	Power supply
1			1769-IQ32	32-point 24V dc input module
1			1769-OB16	16-point 24V dc sourcing output module
1			1769-ECR	End cap
1	Software	RSLogix 5000	9342-RLD300ENE	Application program software
1		FactoryTalk View ME	9701-VWMR030AENE	HMI visualization software

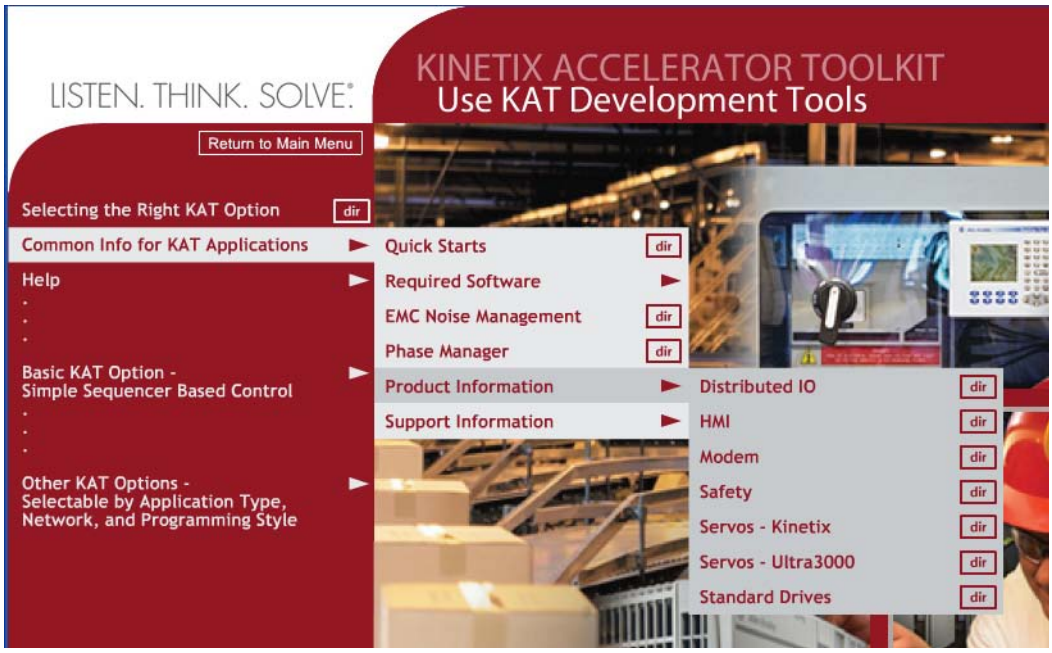
Select System Components

Follow these steps to select an entire system or add components to your base system.

1. If you have not already done so, follow the instructions in Install Kinetix Accelerator Toolkit from DVD on page 13 and Get Motion Analyzer Software on page 14 to install the Kinetix Accelerator Toolkit DVD and Motion Analyzer and Motion Selector software on your personal computer.

2. Open the Kinetix Accelerator Toolkit software and click Use the KAT Development Tools.

3. Browse to the Product Information folders.



4. Identify needed components listed in the Product Information folders that you would like to add to your system.

5. If necessary, identify additional components not listed in the Product Information folders. Contact your local Rockwell Automation distributor or sales representative for more information.

Notes:

Plan System Layout

In this chapter you layout the system components selected in Chapter 1. Remove components from the basic motion control panel system or add components using the CAD drawings supplied on the Kinetix Accelerator Toolkit DVD. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.

Before You Begin

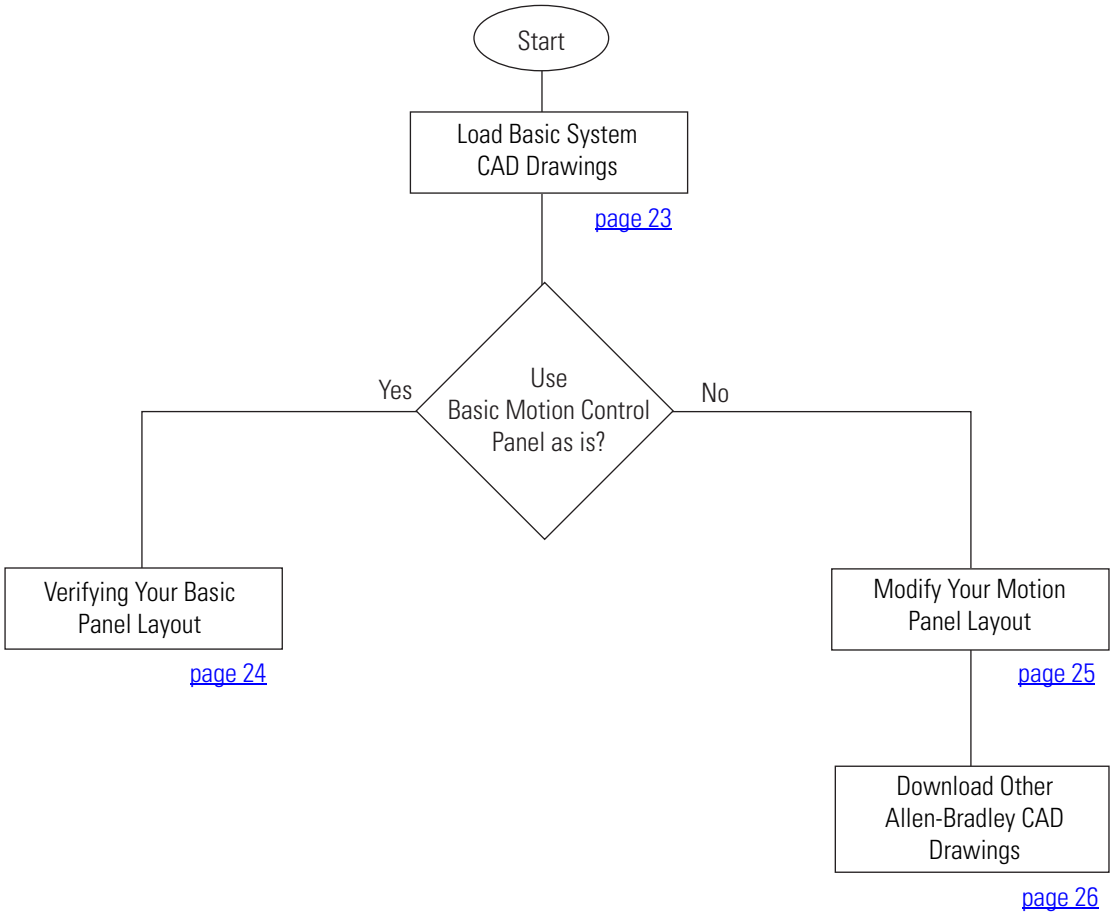
Complete your system hardware selection. (Refer to Chapter 1.)

What You Need

- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004
- System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001
- System Design for Control of Electrical Noise Video, publication GMC-SP004
- Kinetix 2000 Multi-axis Servo Drive User Manual, publication 2093-UM001
- Kinetix 6000 Multi-axis Servo Drive User Manual, publication 2094-UM001
- Kinetix 7000 High Power Servo Drive User Manual, publication 2099-UM001

Follow These Steps

Complete the following steps to plan your system layout within the enclosure.



Load Basic System CAD Drawings

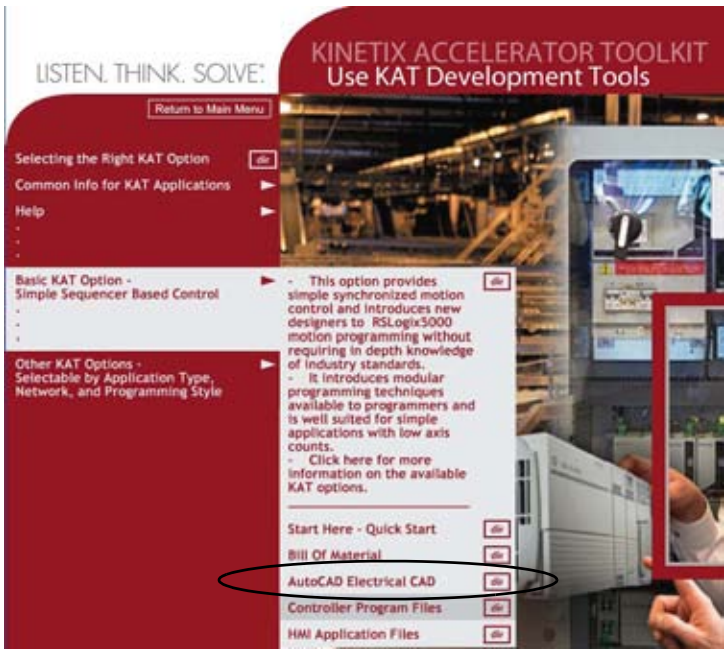
The Kinetix Accelerator Toolkit DVD provides CAD drawings, in DWG and DXF format, to assist in planning the layout of your system. The drawings are designed to optimize panel space and to minimize electrical noise.

Follow these steps to load the CAD files from the Kinetix Accelerator Toolkit DVD.

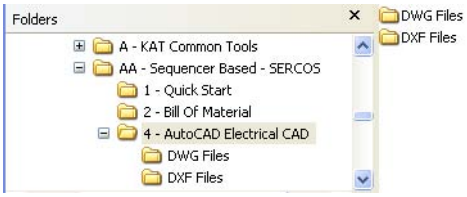
1. If you have not already done so, follow the instructions in Install Kinetix Accelerator Toolkit from DVD on page 13 to install the Kinetix Accelerator Toolkit DVD and Motion Analyzer and Motion Selector software on your personal computer.

2. Choose Start > Programs > Rockwell Automation > Simplification > Kinetix Accelerator Toolkit and click Use The KAT Development Tools.

3. Browse to the AutoCAD Electrical CAD folders.



4. Double-click the DWG Files or DXF Files folder.



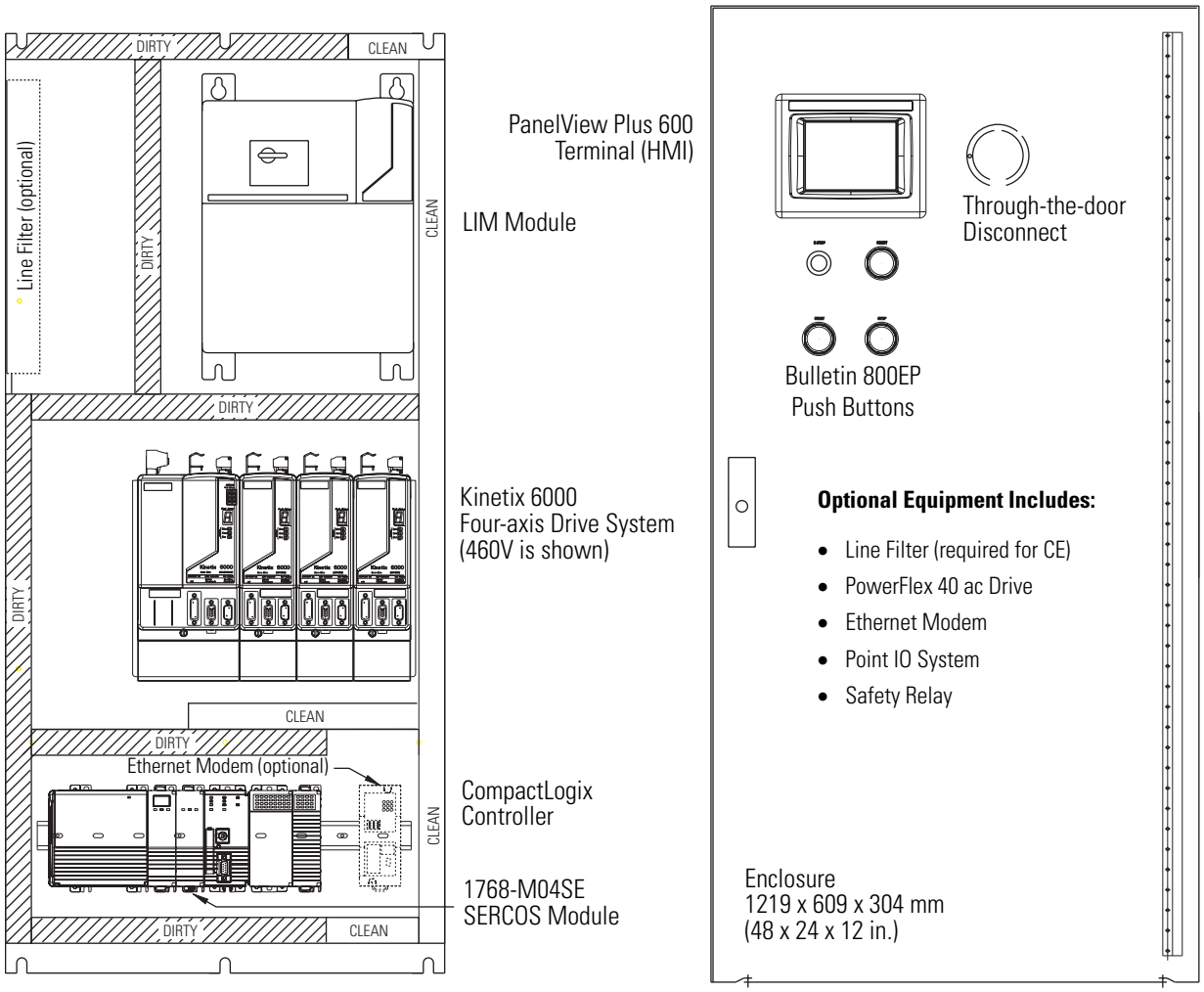
5. Use your CAD program to open these and other enclosure CAD files.
   - KAT_230_23_PANEL_LAYOUT.dwg
   - KAT_230_24_ENCLOSURE_LAYOUT.dwg
   - KAT_CAD_DRAWING_SUMMARY.pdf

6. Identify additional layout needs specific to your application.

Verifying Your Basic Panel Layout

The basic (460V) motion control panel layout is shown below. Included is a four-axis Kinetix 6000 drive system with Line Interface Module (LIM), PanelView Plus 600 terminal, and CompactLogix controller with SERCOS module.

Sample Information from Enclosure Files



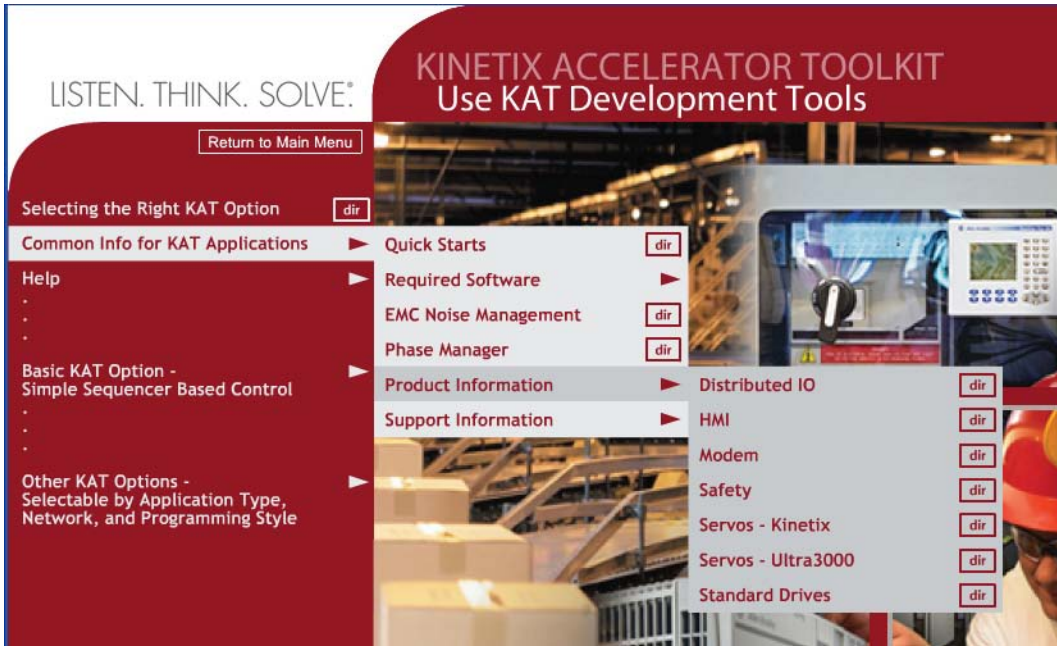
IMPORTANT The enclosure CAD drawings were designed using best-practices techniques as shown in the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001. Refer to this publication when making modifications to the basic motion control panel layout.

Refer to your servo drive user manual for panel layout instructions specific to that drive family.

Modify Your Motion Panel Layout

Follow these steps to modify your motion panel layout.

1. Remove equipment from the basic motion control panel CAD drawing you do not need for your application.
2. Install the Kinetix Accelerator Toolkit software and click Use the KAT Development Tools.
3. Browse to the Product Information folders.



4. Copy and paste objects from the optional equipment CAD drawings to the basic motion control panel drawing.
5. Select other hardware, as needed.

   Refer to Download Other Allen-Bradley CAD Drawings on page 26. Refer to the Literature Library (http://www.literature.rockwellautomation.com) for access to publications.
6. Determine if the combination of your duty cycle and selected components require additional cooling.

   For enclosure sizing example, refer to your servo drive user manual.

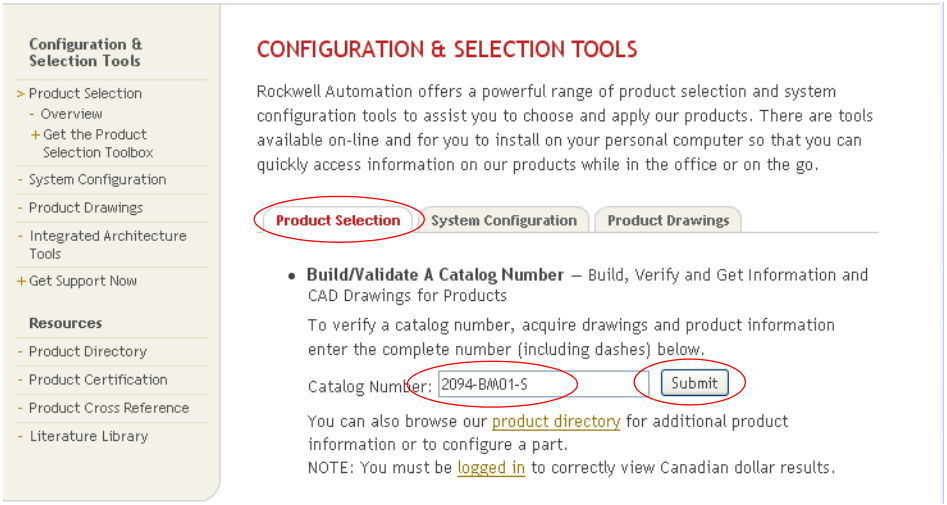
Download Other Allen-Bradley CAD Drawings

Follow these steps to download other Allen-Bradley product CAD drawings.

1. Open your Web browser and go to http://www.rockwellautomation.com/en/e-tools.

   The Configuration and Selection Tools webpage opens.

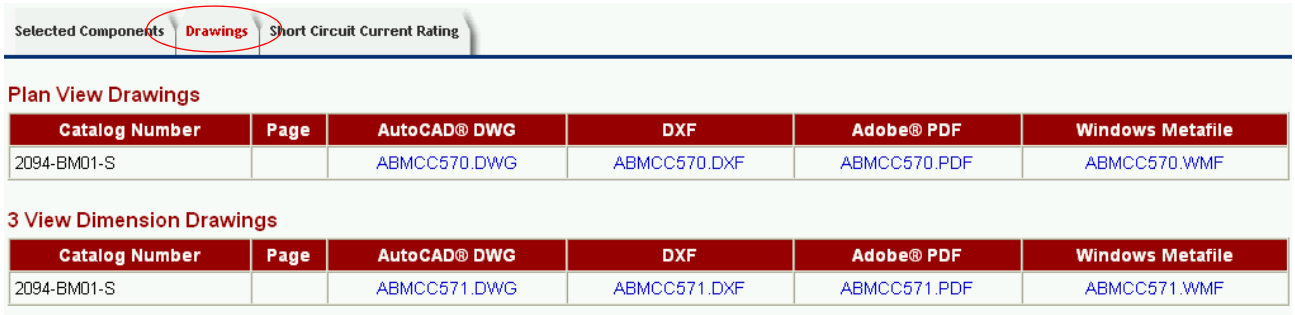
   Product Selection is the default tab.



2. Type the Catalog Number of the product.

3. Click Submit.

   The Configuration Results dialog opens.



4. Click the Drawings tab.

5. Click a file to download.

Plan System Wiring

In this chapter you plan the cable layout for your system components placed in Chapter 2. Use the CAD drawings supplied on the Kinetix Accelerator Toolkit DVD to assist in the routing of wires and cables for your system components. For a copy of the DVD, contact your Rockwell Automation distributor or sales representative.

Before You Begin

- Complete your system hardware selection. (Refer to Chapter 1.)
- Complete your system layout (refer to Chapter 2).

What You Need

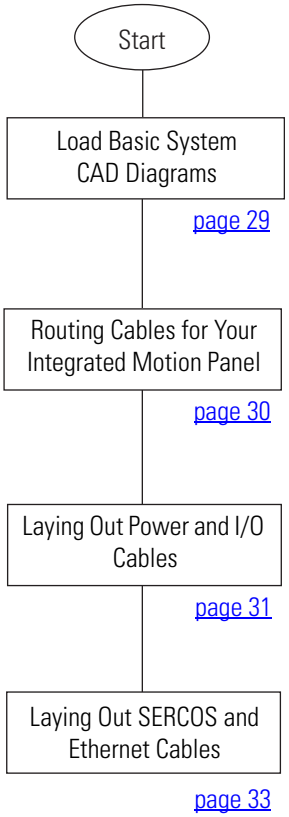
- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004
- CAD files typical of those included on the Kinetix Accelerator Toolkit DVD
  - KAT_230_1_POWER_DISTRIBUTION.dwg
  - KAT_230_2_POWER_DISTRIBUTION.dwg
  - KAT_230_3_230v_POWER.dwg
  - KAT_230_4_120v_POWER.dwg
  - KAT_230_5_LIM_DISTRIBUTION.dwg
  - KAT_230_6_SAFETY_RELAY.dwg
  - KAT_230_7_24V_CONTROL_POWER.dwg
  - KAT_230_8_DRIVE1_IO.dwg
  - KAT_230_9_DRIVE1_ENCODER.dwg
  - KAT_230_10_DRIVE2_IO.dwg
  - KAT_230_11_DRIVE2_ENCODER.dwg
  - KAT_230_12_DRIVE3_IO.dwg
  - KAT_230_13_DRIVE3_ENCODER.dwg
  - KAT_230_14_DRIVE4_IO.dwg
  - KAT_230_15_DRIVE4_ENCODER.dwg
  - KAT_230_16_DRIVE5_IO.dwg
  - KAT_230_17_SPARE.dwg
  - KAT_230_18_SPARE.dwg
  - KAT_230_19_PLC_INPUT.dwg
  - KAT_230_20_PLC_OUTPUT.dwg
  - KAT_230_21_POINT_IO.dwg
  - KAT_230_22_POINT_IO.dwg
  - KAT_230_23_PANEL_LAYOUT.dwg
  - KAT_230_24_ENCLOSURE_LAYOUT.dwg
  - KAT_230_25_NETWORK_CONNECTIONS.dwg
  - KAT_CAD_DRAWING_SUMMARY.pdf

- Kinetix 2000 Multi-axis Servo Drive User Manual, publication 2093-UM001
- Kinetix 6000 Multi-axis Servo Drive User Manual, publication 2094-UM001
- Kinetix 7000 High Power Servo Drive User Manual, publication 2099-UM001
- Line Interface Module Installation Instructions, publication 2094-IN005
- System Design for Control of Electrical Noise, publication GMC-RM001
- System Design for Control of Electrical Noise Video, publication GMC-SP004
- Documentation that came with your other Allen-Bradley products

  Refer to the Literature Library (http://www.literature.rockwellautomation.com) for access to publications.

Follow These Steps

Complete the following steps to plan the installation and wiring of your system components within the enclosure.



Load Basic System CAD Diagrams

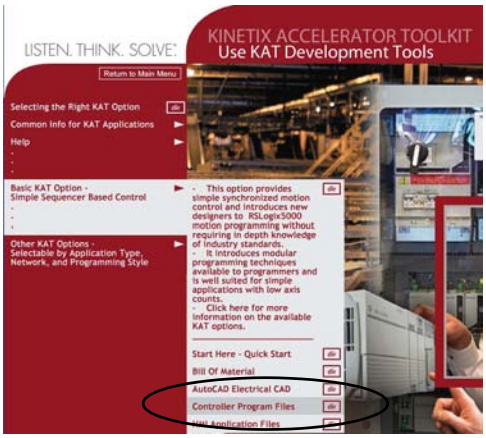
The Kinetix Accelerator Toolkit DVD provides CAD diagrams, in DWG and DXF format, to assist in the planning of your system wiring. The diagrams are designed to optimize panel space and to minimize electrical noise.

Follow these steps to load CAD files from the Kinetix Accelerator Toolkit DVD.

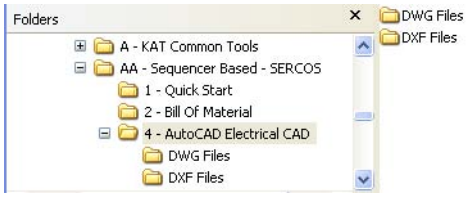
1. If you have not already done so, follow the instructions in Install Kinetix Accelerator Toolkit from DVD on page 13 to install the Kinetix Accelerator Toolkit DVD on your personal computer.

2. Choose Start > Programs > Rockwell Automation > Simplification > Kinetix Accelerator Toolkit and click Use The KAT Development Tools.

3. Browse to the AutoCAD Electrical CAD folder.



4. Double-click the DWG Files or DXF Files folder.



5. Use your CAD program to open these and other enclosure CAD files.

   - KAT_230_23_PANEL_LAYOUT
   - KAT_230_24_ENCLOSURE_LAYOUT
   - KAT_CAD_DRAWING_SUMMARY.pdf

6. Use your CAD program to open these and other wiring diagram CAD files.

   - KAT_230_1_POWER_DISTRIBUTION
   - KAT_230_25_NETWORK_CONNECTIONS

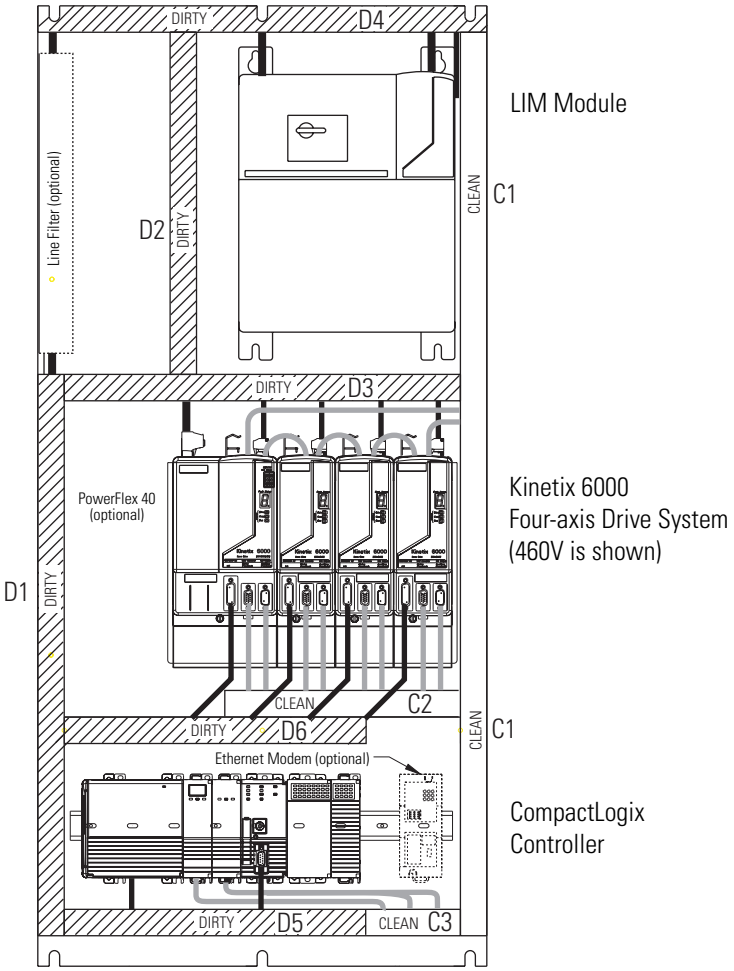
7. Identify additional wiring needs specific to your application.

Routing Cables for Your Integrated Motion Panel

This system enclosure diagram is an example of the four-axis motion control panel, including noise zones. The enclosure CAD drawings are provided as examples of best-practices techniques used to minimize electrical noise, as covered in the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

The enclosure diagram provides designators that coordinate with the wiring diagrams, illustrating where to route your power and I/O cables.

Sample Information from Enclosure Files - Example



Noise Zone Legend

CLEAN C2

CLEAN wireway for noise sensitive device circuits.

DIRTY D6

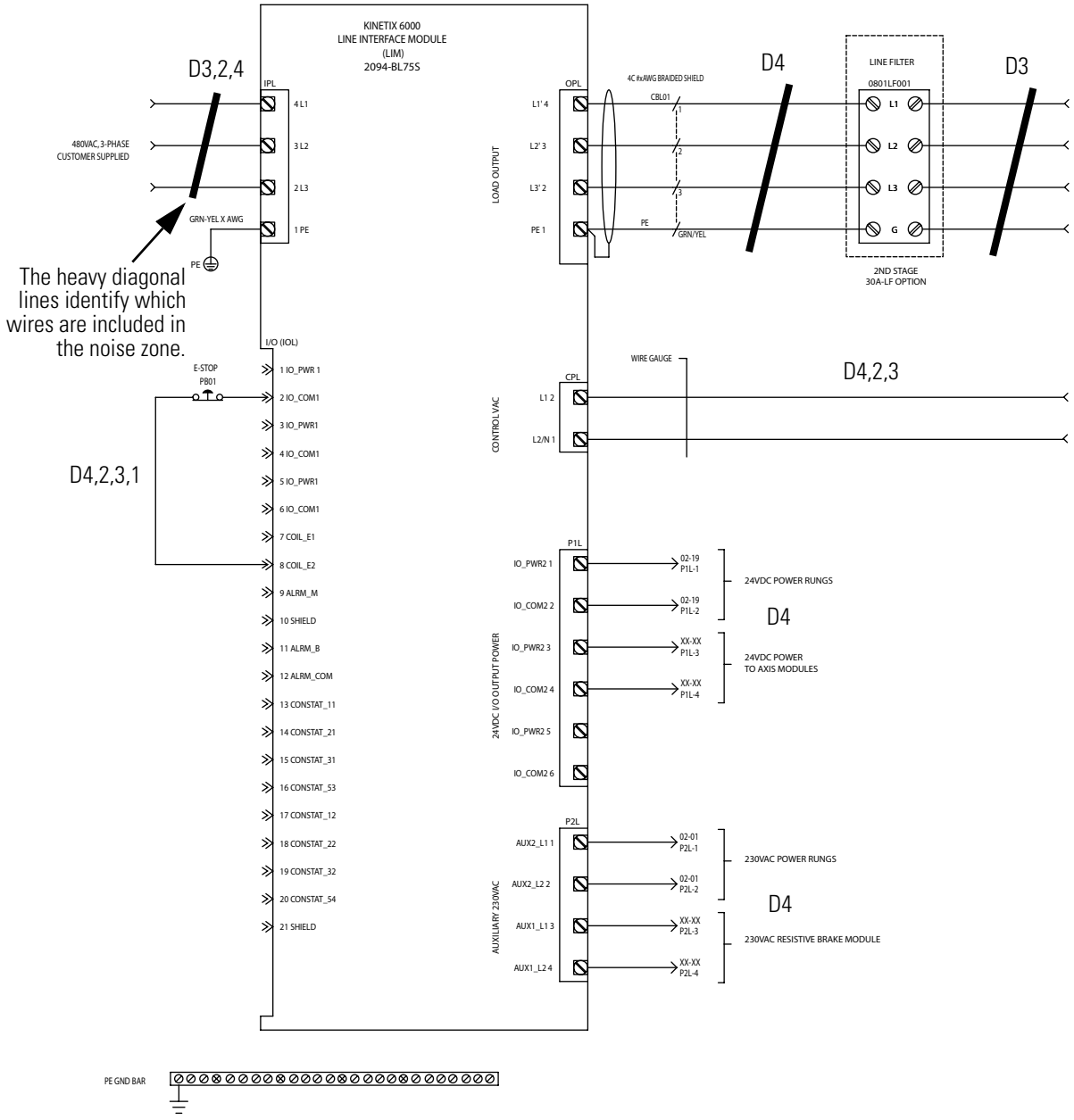
DIRTY wireway for noise generating device circuits.

IMPORTANT Refer to your servo drive user manual for installation and wiring instructions specific to that drive family. For other equipment shown in your CAD drawings, refer to the installation instructions that came with those products.

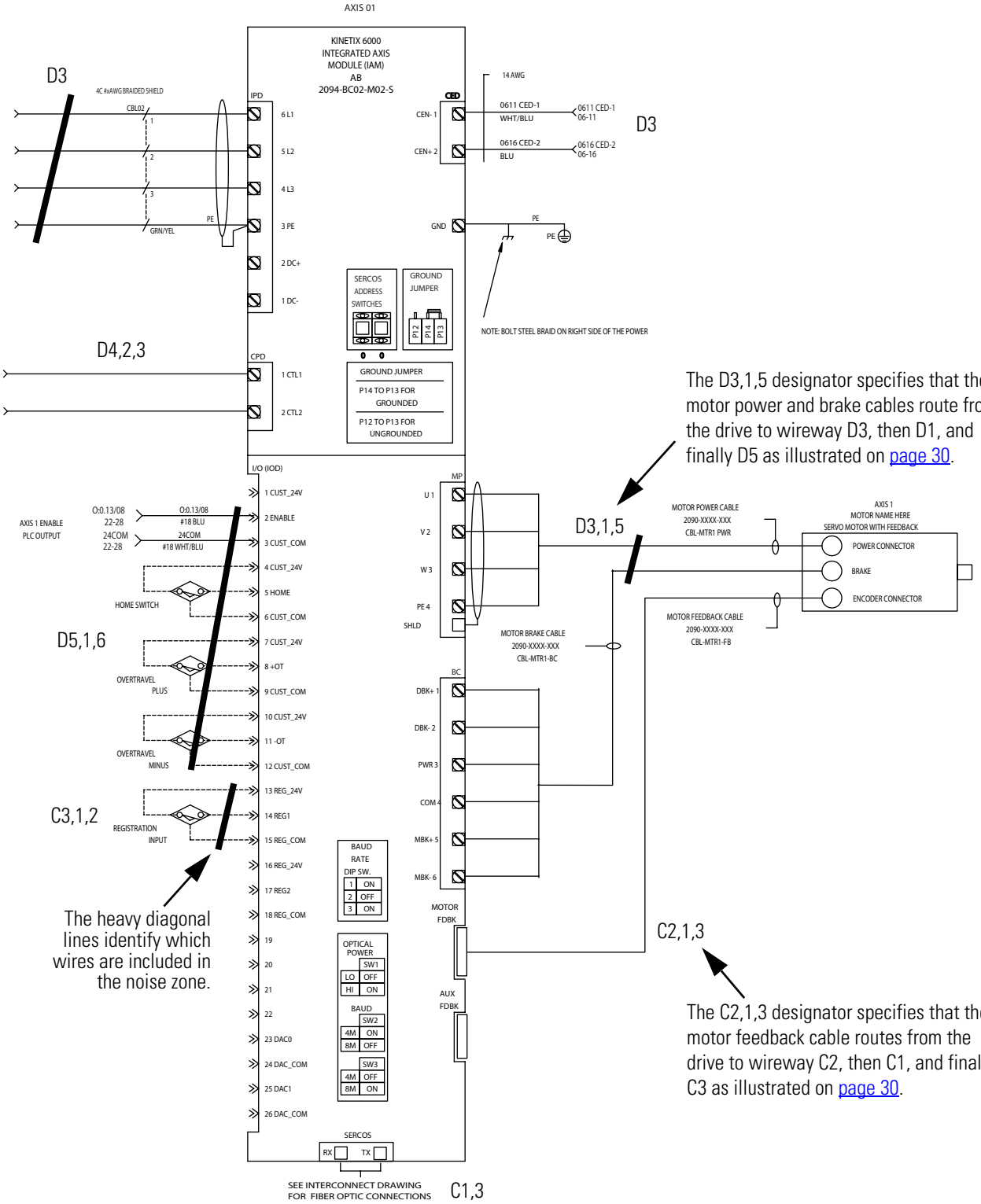
Laying Out Power and I/O Cables

This diagram is an example of routing power and I/O cables, including the noise zones. The diagram provides designators that coordinate with the enclosure diagram, indicating where to route your power and I/O cables. To locate the noise zones in your enclosure (D1, D2, C1, C2, for example), refer to the diagram on page 30.

Sample Information from Wiring Diagram Files - Example 1



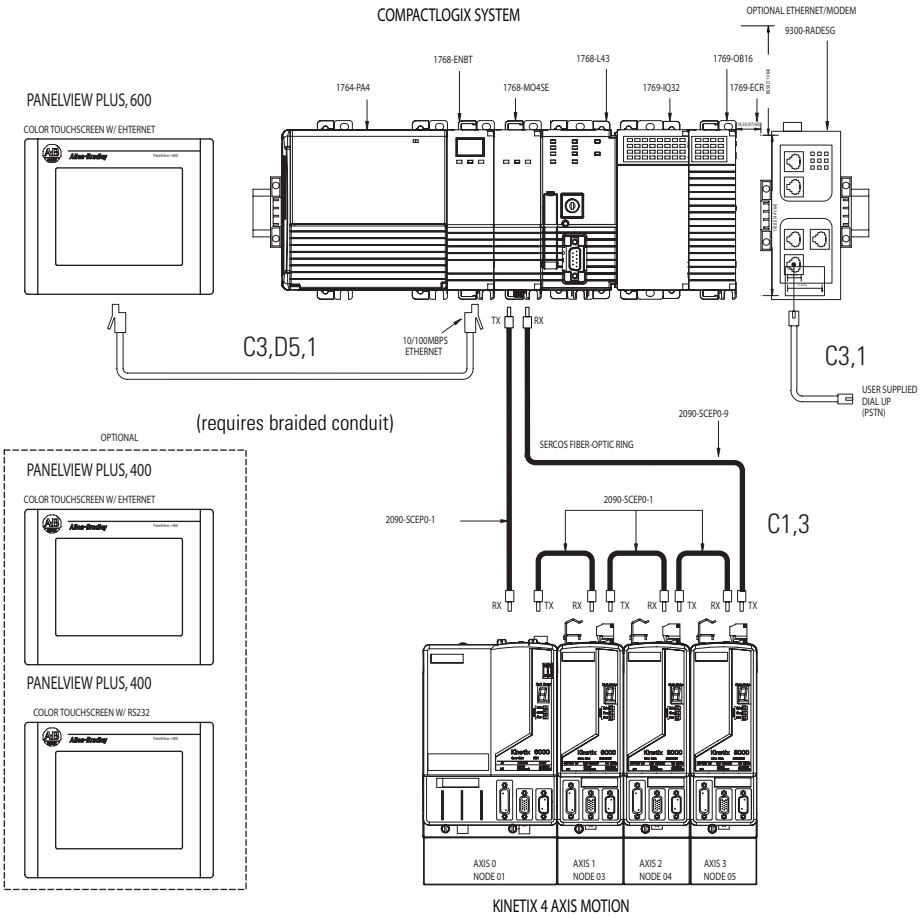
Sample Information from Wiring Diagram Files - Example 2



Laying Out SERCOS and Ethernet Cables

This diagram is an example of wiring SERCOS and Ethernet cables, including the noise zones. The diagram provides designators that coordinate with the panel diagram, indicating where to route your SERCOS and Ethernet cables.

Sample Information from Wiring Diagram Files - Example 3



Notes:

Motion Logix Integration

In this chapter, you will learn to configure your RSLogix 5000 application file. Logix application files (.acd) are included in the Controller Program Files folder on the Kinetix Accelerator Toolkit DVD.

Use the processes in this chapter to configure the Logix and drive modules, add axes if needed, and download the program.

Refer to Logix programming manuals for additional device configuration and programming Requirements.

Before You Begin

- Complete your system hardware selection. (Refer to Chapter 1.)
- Complete your system layout. (Refer to Chapter 2.)
- Complete your system wiring. (Refer to Chapter 3.)

What You Need

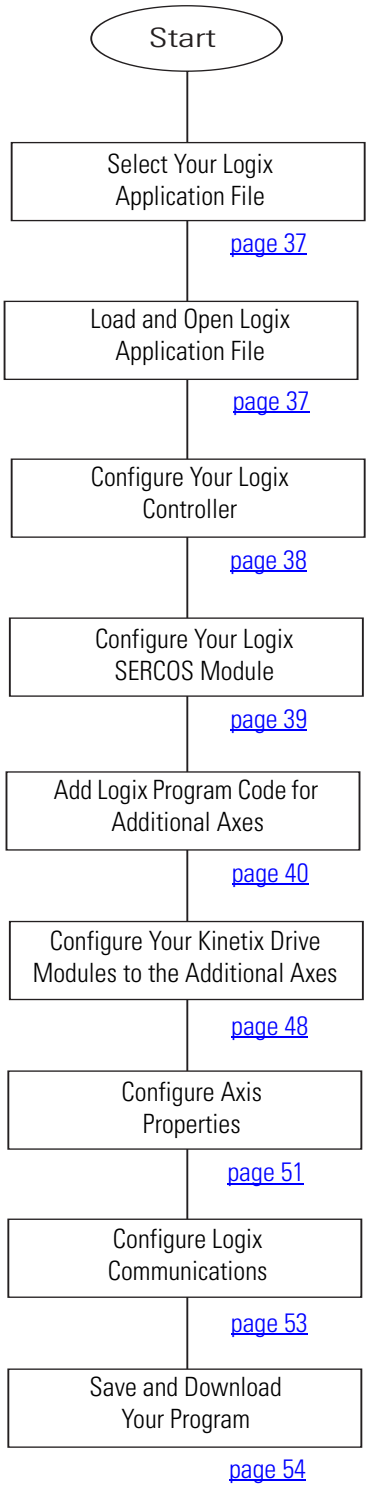
- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004
- RSLogix 5000 software, version 17.0 or later
- RSLinx Classic software, version 2.54 or later
- Logix application file, Power_Programming_CLX_V4_00_Core.acd

  The Logix file is available on the Kinetix Accelerator Toolkit DVD. For a copy of this DVD, contact your local Rockwell Automation distributor or sales representative.

- Kinetix 6000 Multi-axis Servo Drive User Manual, publication 2094-UM001
- Motion Modules in Logix5000 Control Systems User Manual, publication LOGIX-UM002
- ControlLogixControllers User Manual, publication 1756-UM001

Follow These Steps

Complete the following steps to configure your Logix Integrated Motion application.



Select Your Logix Application File

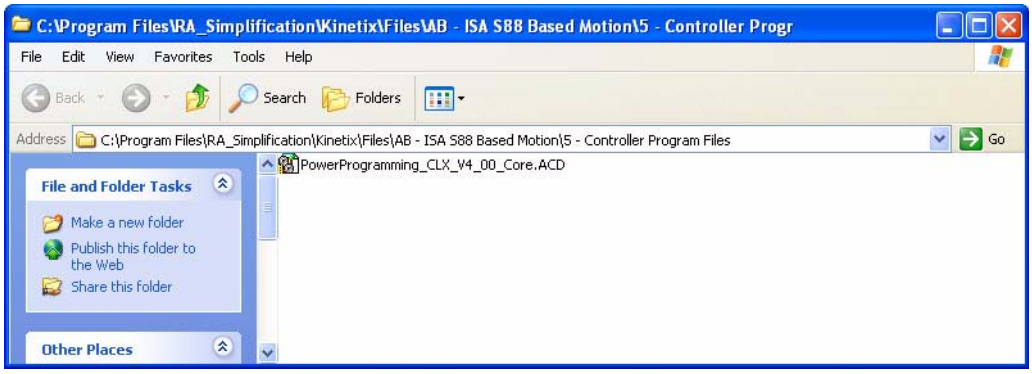
Logix Platform	Logix File Name	Description
CompactLogix, ControlLogix, or SoftLogix	Power_Programming_CLX_V4_00_Core.acd	Logix file for generic base applications. Can be configured for any Kinetix 6000 power rail configuration and CompactLogix, ControlLogix, or SoftLogic controller.

Load and Open the Logix Application File

Follow these steps to load and open the Logix application file from the Kinetix Accelerator Toolkit DVD.

1. Copy the Kinetix Accelerator Toolkit DVD to your personal computer hard drive.
2. Open the Controller Program Files folder.

3. Double-click the Logix (.acd) application file.



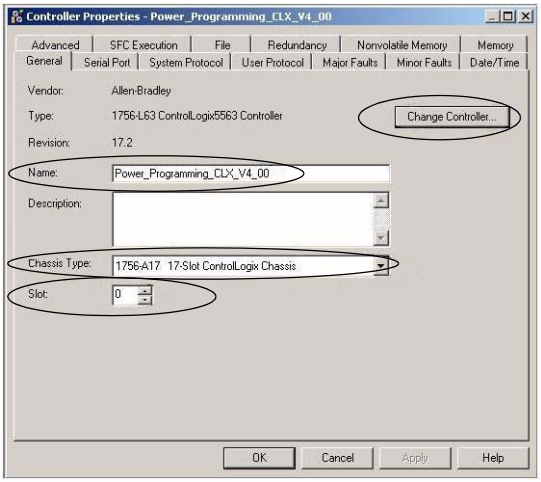
The RSLogix 5000 software launches and your application file opens.

Configure Your Logix Controller

Follow these steps to configure your Logix controller.

1. Apply power to your Logix chassis or computer containing the SERCOS interface module.
2. Select Controller Properties in the Edit menu.

   The Controller Properties window opens.



3. In the Controller Properties window, select the General tab.
4. Set the following Controller Properties:

   a. Click Change Controller to select the controller type to match your actual hardware

   b. Modify the controller Name, as appropriate.

   c. Select the Logix Chassis Type.
   (This step is not required for CompactLogix setup).

   d. Select the Logix controller Slot.
   (The left-most slot = 0.)

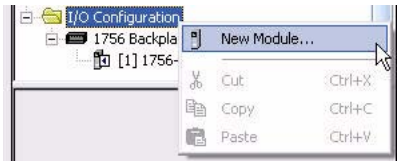
5. Click OK.

Configure Your Logix SERCOS Module

Follow these steps to configure your Logix module.

1. In the Explorer window, right-click I/O Configuration and then select New Module.

   The Select Module window opens.



2. Expand the Motion category and select 1756-M*xx*SE, 1768-M04SE, or 1784-PM16SE as appropriate for your actual hardware configuration.

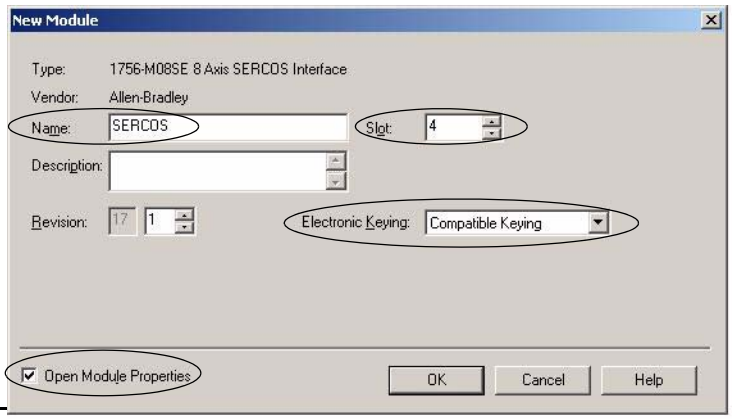
3. Click OK.

   The New Module window opens. Your new module appears under the I/O Configuration folder in the Explorer window.

4. In the Name field, enter the module Name.

5. Select the Slot where your module resides. (The left-most slot = 0.)

6. Select an Electronic Keying option. (Use the guidelines in the following table to determine which Electronic Keying option to select;. If you are unsure which option to select, select Disable Keying.)

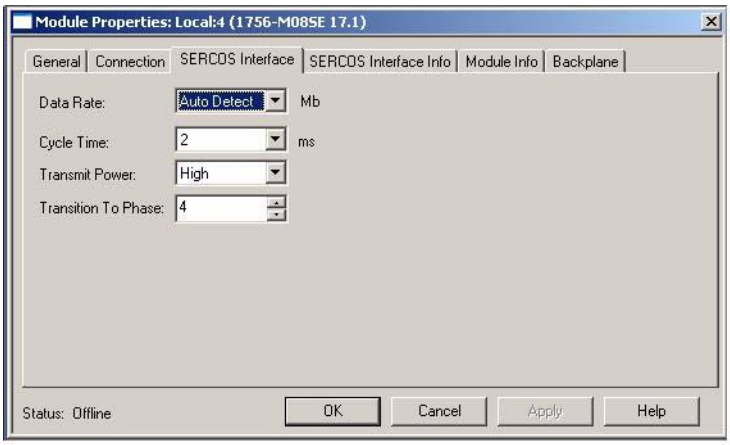


Electronic Keying	Selection Guidelines
Compatible	Choose Compatible Keying if you require the major version of RSLogix 5000 software to match your motion module's major firmware revision.
Exact	Choose Exact Keying if you require the major and minor version of RSLogix 5000 software to match your motion module's major firmware revision.
Disable	Choose Disable Keying if you are unsure.

7. Check box Open Module Properties.

8. Click OK.

The Module Properties window opens.



9. Click the SERCOS Interface tab.

Do not change the default values unless they differ from drive settings.

For more information, refer to the Logix5000 Motion Modules User Manual, publication LOGIX-UM002.

10. Click OK.

11. Repeat steps 1…10 for each Logix SERCOS module.

Add Logix Program Code for Additional Axes

Use the instructions in this section to add Logix program code by duplicating existing code when your application requires additional axes. Duplicating the already-tested program code of an existing axis saves time and is easier than creating it yourself.

The procedures described in the following bulleted list summarize the process.

- Export an Axis Equipment Module Program
- Import an Axis Equipment Module Program
- Add EM03 to Sample Recipe UDT
- Link Axes Program Tags to Controller Tags
- Copy Cam Profile to New EM

Export an Axis Equipment Module Program

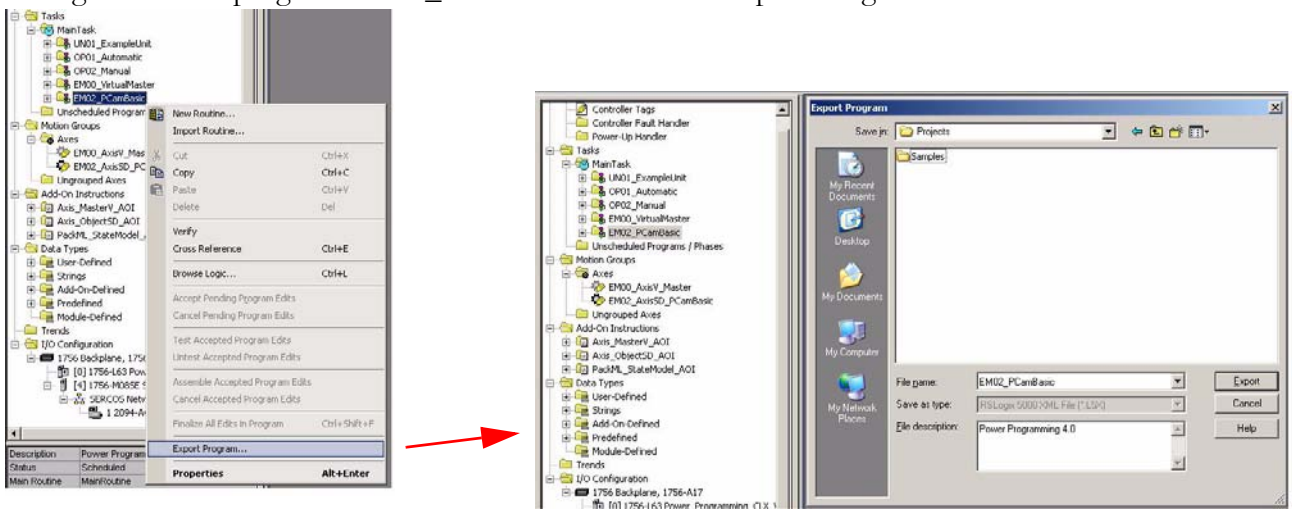
The ControlLogix base application file (Power_Programming_CLX_V4_00_Core.acd) contains program code for one physical servo axis and one virtual axis.

In this example, you will duplicate the program code of EM02_AxisSD_PCamBasic and create EM03_AxisSD_PCamBasic.

Follow these steps to export an axis-equipment module program.

1. Expand the MainTask tree.

2. Right-click the program EM02_PCamBasic and select Export Program.



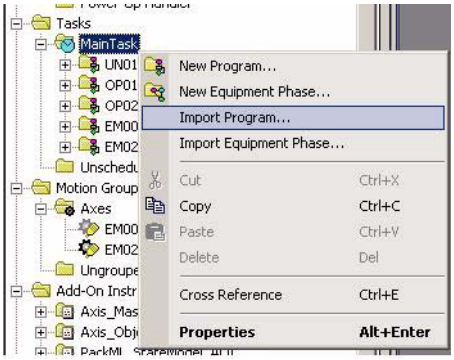
3. Click Export.

Import an Axis Equipment Module Program

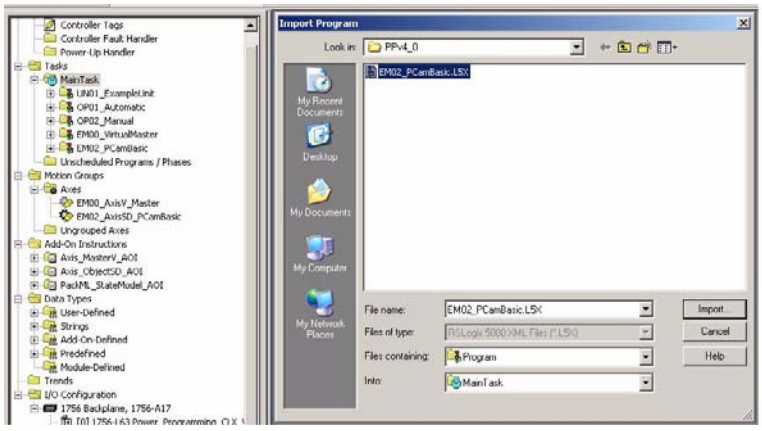
In the following example, you will duplicate the program file EM02_PCamBasic and create EM03_PCamBasic.

Follow these steps to duplicate an axis equipment module program and create another.

1. Right-click MainTask and select Import Program.

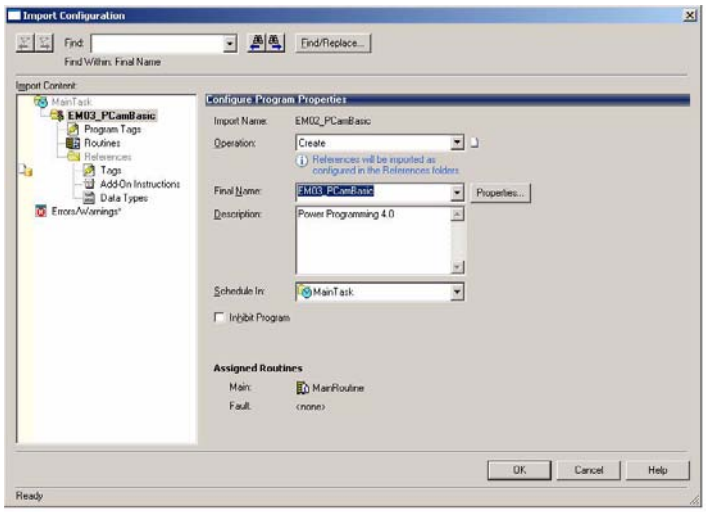


2. Select the folder where you exported the Axis program file, select file EM02_PCamBasic, and then click Import.



3. Change the Final Name to EM03_PCamBasic.

Note: The Operation will change to Create.

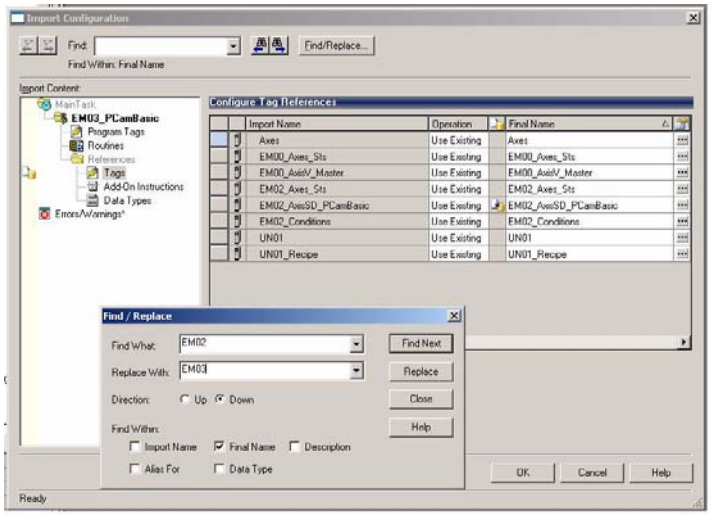


4. Under Import Content, select Tags.

5. Select Find/Replace and replace all instances of EM02 with EM03.

6. After you have completed Step 5, click OK.

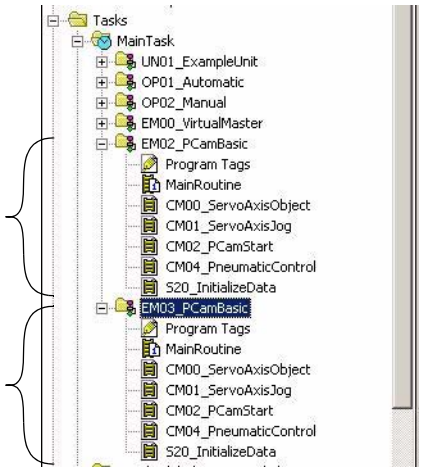
7. Expand the EM03_PCamBasic axis program file that you just created, and verify that the routines in EM03_PCamBasic match the routines in EM02_PCamBasic.



Note: The new axis "EM03_AxisSD_PCamBasic" will be generated Automatically; however, the associated module and Motor

Catalog Number still have to be assigned to the new axis.

8. Repeat steps 1...7 for each axis program file that you want to add.



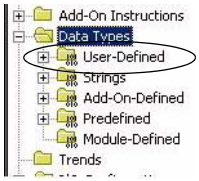
Add EM03 to Sample Recipe UDT

In the following example, you will duplicate the recipe tag EM02 and create the recipe EM03.

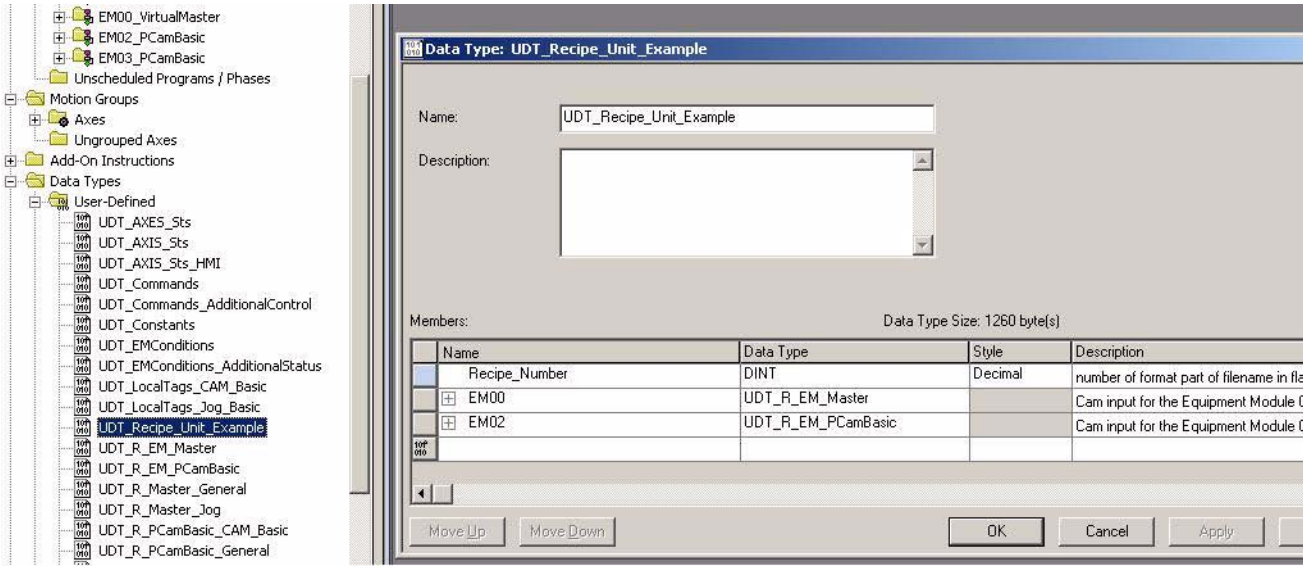
Follow these steps to duplicate the recipe tag for EM02 and add EM03 to sample Unit recipe UDT (UDT_Recipe_Unit_Example), duplicate the recipe tag.

1. Expand the Data Types tree.

2. Expand the User-Defined tree.



3. Double-click UDT_Recipe_Unit_Example.

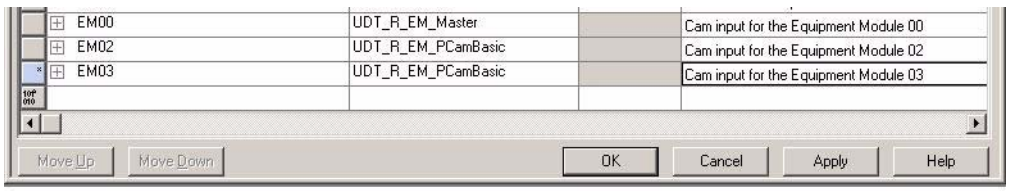


4. Duplicate member EM02. To do this, follow these steps:

a. Right-click the row for the EM02 member, and then select Copy.

a. Right-click the empty row, and then select Paste.

5. Rename EM02 to EM03 and change the description from Equipment Module 02 to Equipment Module 03.

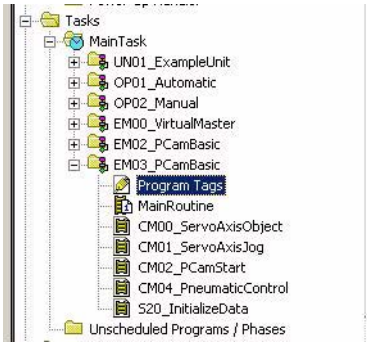


6. Click Apply or OK.

Link Axes Program Tags to Controller Tags

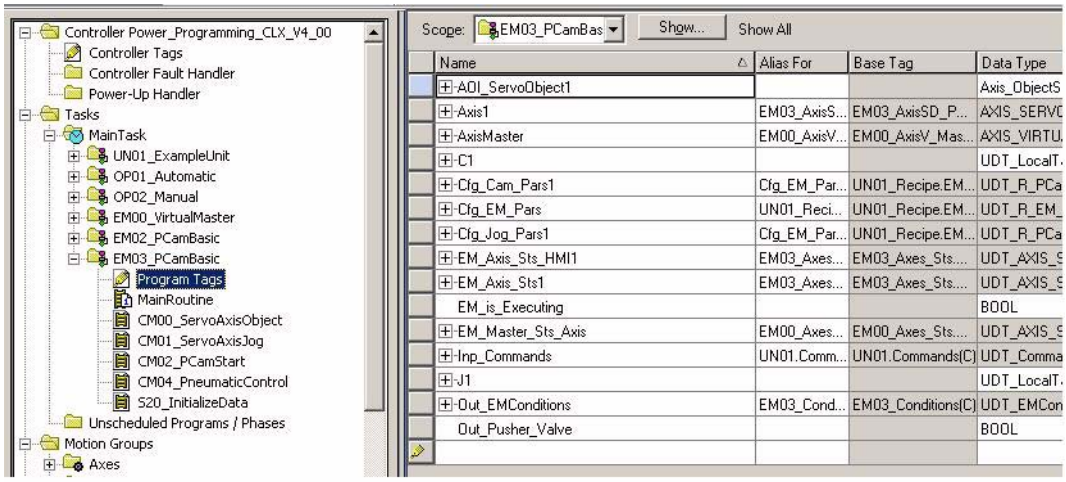
In this example, you will link the program tags for EM03_PCamBasic that you created in the preceding example.

Follow these steps to re-link (alias) program tags to controller tags.



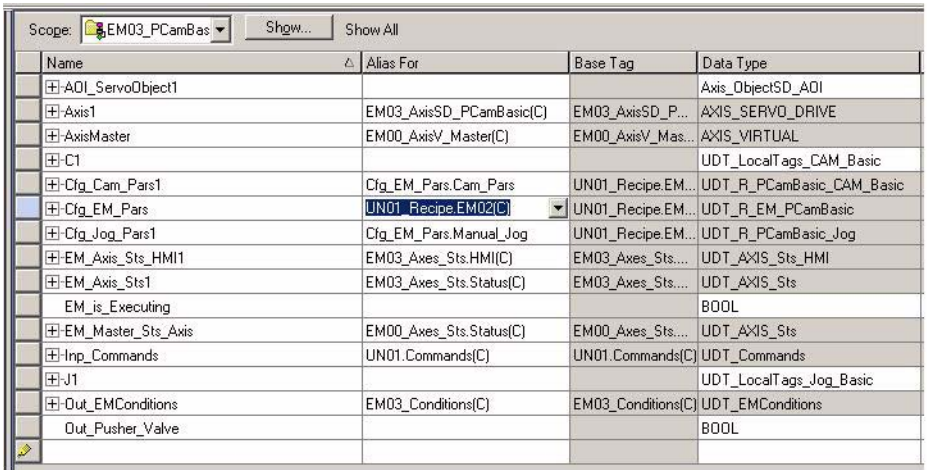
1. Expand the EM03_PCamBasic axis program file that you created in the Import an Axis Equipment Module Program section.

2. Double-click Program Tags.



3. Select the Edit Tags tab at the bottom of the Program Tags window.

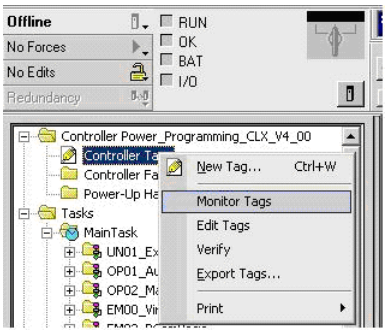
4. Replace UN01_Recipe.EM02 with UN01_Recipe.EM03.



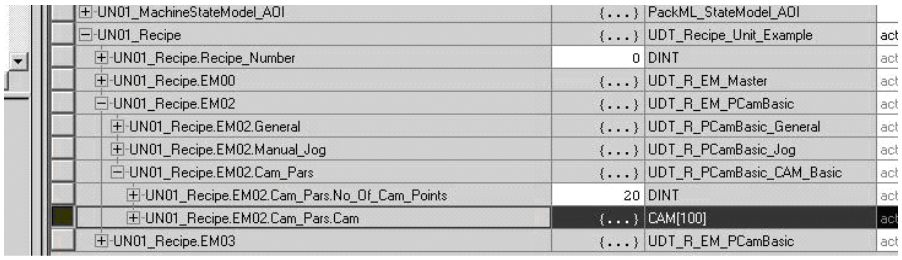
Copy Cam Profile to New EM

1. In RSLogix 5000 software, expand the Explorer window to gain access to the Controller Folder.
2. Expand the Controller Folder and select Controller Tags.
3. Right-click Controller Tags, and then select Monitor Tags.

   The Controller Tags database editor will open in the window in which you are working.



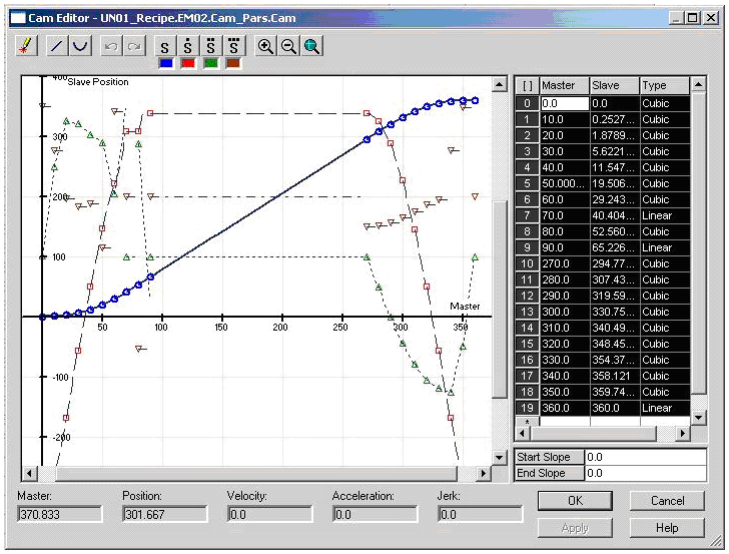
4. Scroll down to the UN01_Recipe tag and expand it.
5. Scroll down to the UN01_Recipe.EM02 tag and expand it.
6. Scroll down to the UN01_Recipe.EM02.Cam_Pars tag and expand it.



7. Right-click the row for tag UN01_Recipe.EM02.Cam_Pars.Cam, and select Configure UN01_Recipe.EM02.Cam_Pars.Cam.

The Cam Editor will open in a new window.

8. Starting at 0 and ending at the final cam point, select all rows of the Cam table, then press Ctrl-C to copy the table.



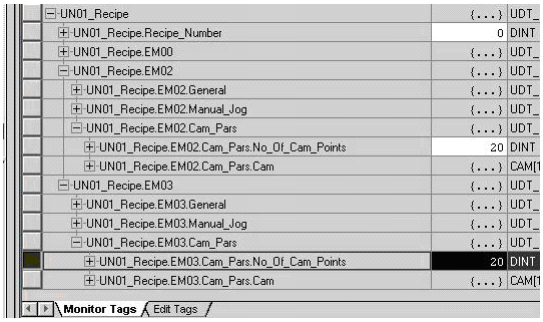
9. Select either OK or Cancel to close the Cam Editor.

10. Repeat steps 5 through 7 to configure the Cam profile for UN01_Recipe.EM03.Cam_Pars.Cam.

11. Select all rows of the Cam table, and press Ctrl-V to paste the Cam table from the clipboard into the newly-configured Cam profile.

12. Select OK to close the Cam Editor.

13. Note the value stored in tag UN01_Recipe.EM02.Cam_Pars.No_Of_Cam_Points. (In this example, the value is 20).



14. For tag UN01_Recipe.EM03.Cam_Pars.No_Of_Cam_Points., enter the value noted in the previous step.

Modify Axis Names

Your ControlLogix application file (Power_Programming_CLX_V4_00_Core.acd) now contains program code for at least two axes. However, you may want to rename the axes from EM02_AxisSD_PCamBasic and EM03_AxisSD_PCamBasic to something more meaningful for your application, for example, Conveyor.

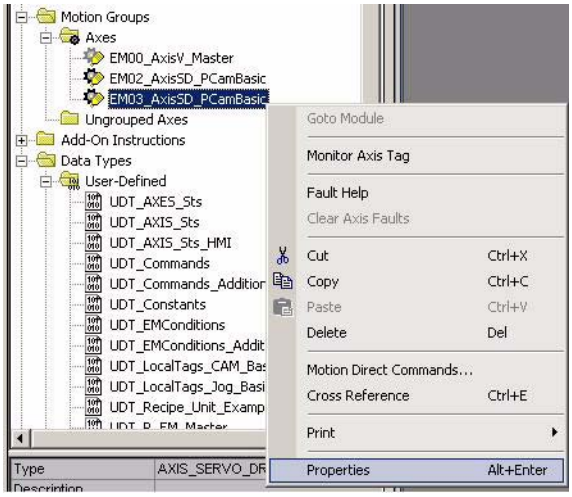
Follow these steps to rename the axes in your RSLogix 5000 program. In this example, EM03_AxisSD_PCamBasic is renamed EM03_AxisSD_Conveyor.

1. In RSLogix 5000 software, expand the Explorer window to gain access to Motion Groups and then Axes.

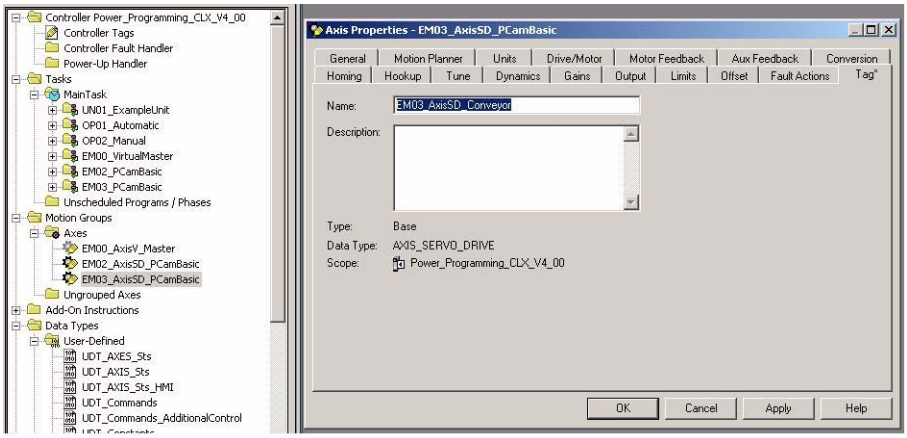
2. Right-click servo drive axis EM03_AxisSD_PCamBasic, and then select Properties.

3. Select the Tag tab and rename EM03_AxisSD_PCamBasic to EMD03_AxisSD_Conveyor.

4. Click Apply or OK



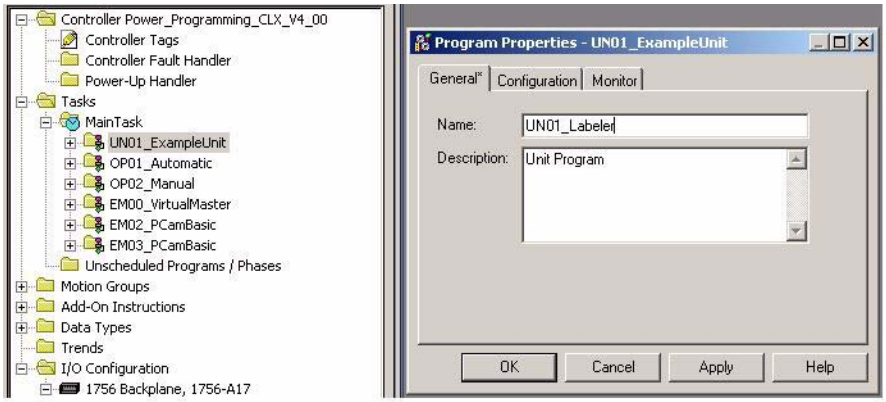
5. Repeat steps 2 and 3 for each axis that you want to rename.



Modify Unit Name

Follow these steps to rename the unit in RSLogix 5000 In this example, UN01_ExampleUnit is renamed UN01_Labeler.

1. In RSLogix 5000 software, expand the Explorer window to gain access to Tasks and then MainTask.
2. Right-click program UN01_ExampleUnit, and then select Properties.
3. Rename UN01_ExampleUnit to UN01_Labeler.
4. Click Apply or OK.



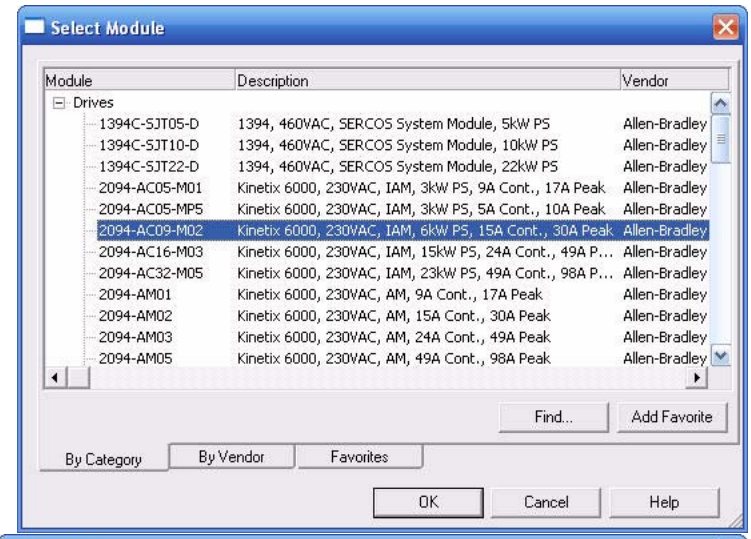
Configure Your Kinetix Drive Modules to the Additional Axes

1. Follow these steps if you want to manually configure your Kinetix drive modules.

   Note: Remember that in the previous examples, you exported and imported EM02_PCamBasic and renamed it from EM02 to EM03, and then from EM03_AxisSD_PCamBasic to EM03_AxisS_Conveyor; when you did this, the appropriate axis was automatically created.

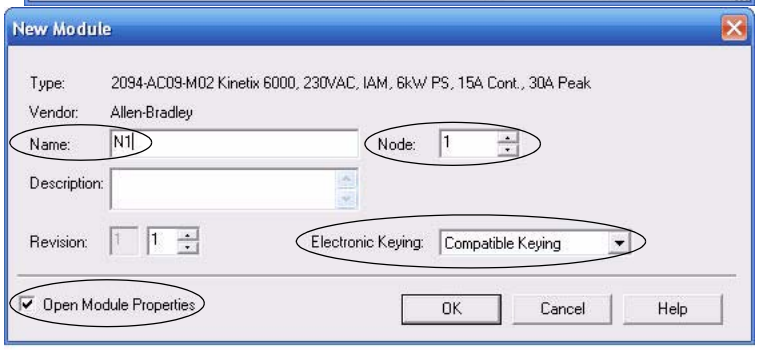
2. Right-click the new Logix SERCOS module that you just created and select New Module.

The Select Module window opens.



3. Select your Drive Module as appropriate for your hardware configuration, and then click OK.

   The New Module window opens.



4. Describe the new module.

   a. Name the module EM03_AxisSD_Conveyor.

   b. Set the Node address in the software to match the node setting on the drive. (For more information about setting the node address for the drive, see the Kinetix 6000 User Manual, publication 2094-UM001.)

   c. Select an Electronic Keying option. (Select Disable Keying if unsure).

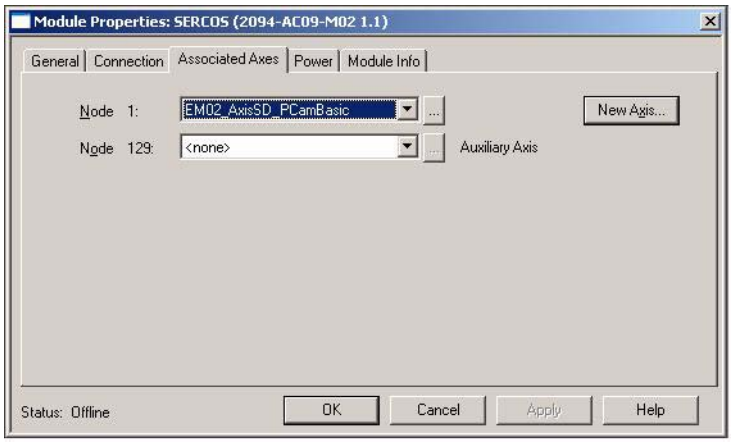
   (Use the guidelines in the following table to determine which Electronic Keying option to select. If you are unsure which option to select, select Disable Keying.)

Electronic Keying	Selection Guidelines
Compatible	Choose Compatible Keying if you require the major version of RSLogix 5000 software to match your motion module's major firmware revision.
Exact	Choose Exact Keying if you require the major and minor version of RSLogix 5000 software to match your motion module's major firmware revision.
Disable	Choose Disable Keying if you are unsure.

   d. Check Open Module Properties box.

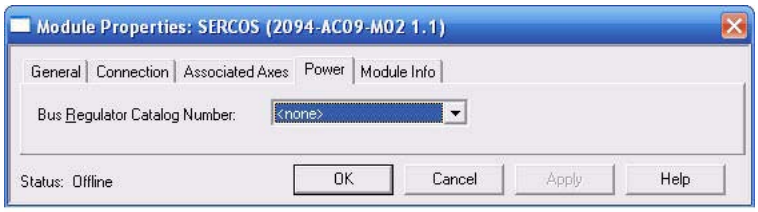
5. Click OK.

The Module Properties window opens.



6. Select the Associated Axes tab.

7. Assign EM02_AxisSD_Conveyor to the node address.



For more information, refer to the Kinetix 6000 Multi-axis Servo Drive User Manual, publication 2094-UM001.

8. Click OK.

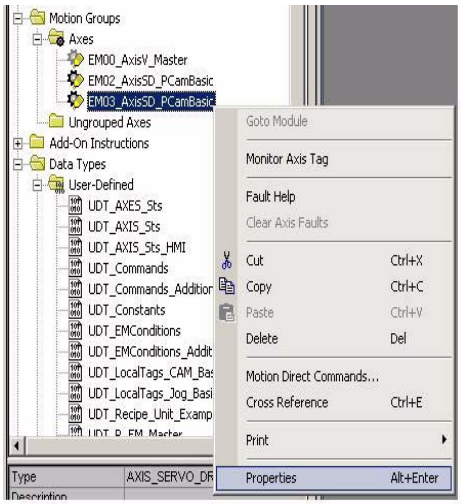
9. Repeat steps 2…7 for each drive module.

Configure Axis Properties

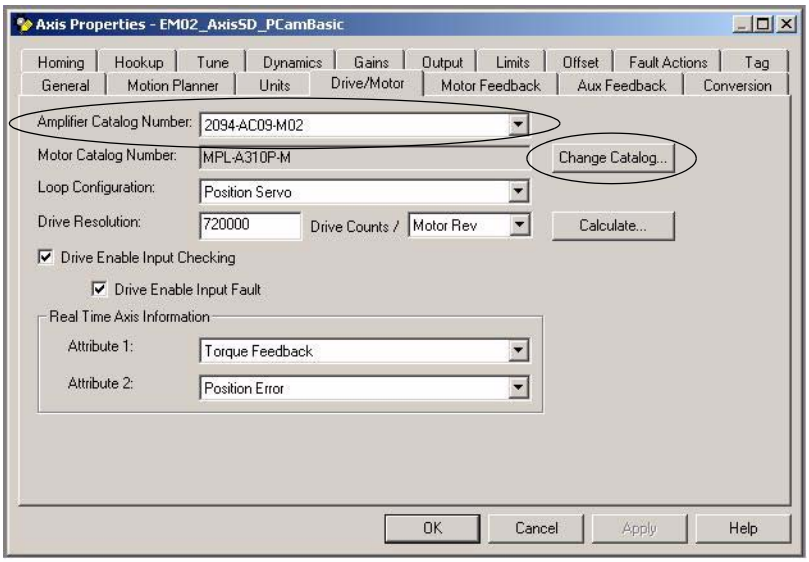
Follow these steps to configure axis properties.

1. Right-click the second physical axis (that is, EM03_AxisSD_Conveyor) in the Explorer window of the Axes Motion Group, and then select Properties.

   (Note: EM00_AxisV_Master is a virtual axis and EM02_AxisSD_PCamBasic is the first physical axis.)



   The Axis Properties window opens.



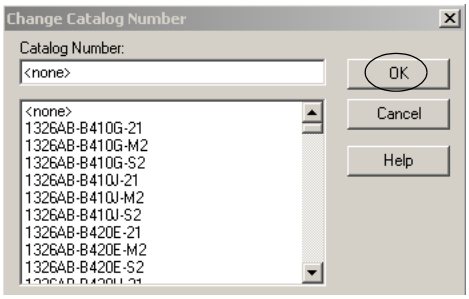
2. Select the Drive/Motor tab.

3. Using the pull-down menu, set the Kinetix drive Amplifier Catalog Number.

   To find the amplifier catalog number, refer to the amplifier name plate.

4. Click Change Catalog.

   The Change Catalog Number window opens.

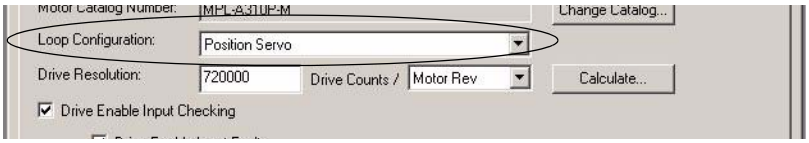


5. To find your motor catalog, enter Number or scroll down.

   For motor catalog number, refer to the motor name plate.

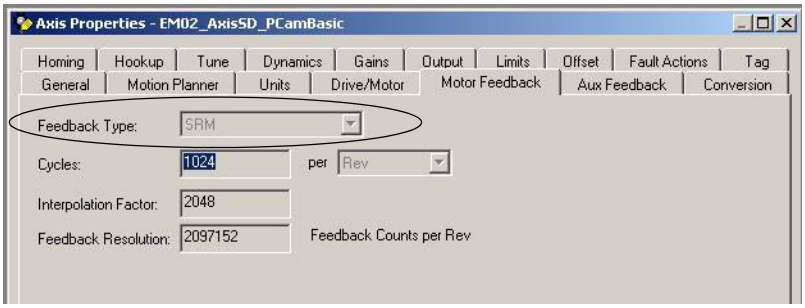
6. Click OK.

7. From the Loop Configuration drop-down menu, choose Position Servo.

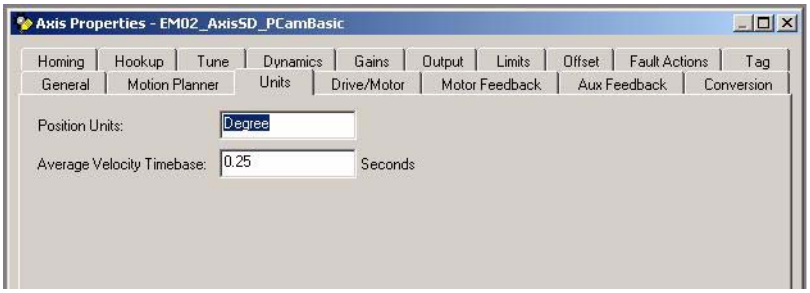


TIP Drive Enable Input Checking, when checked, means a hard drive enable input signal is required. When unchecked, the requirement is removed.

8. Select the Motor Feedback tab and verify the Feedback Type shown is appropriate for your hardware configuration.



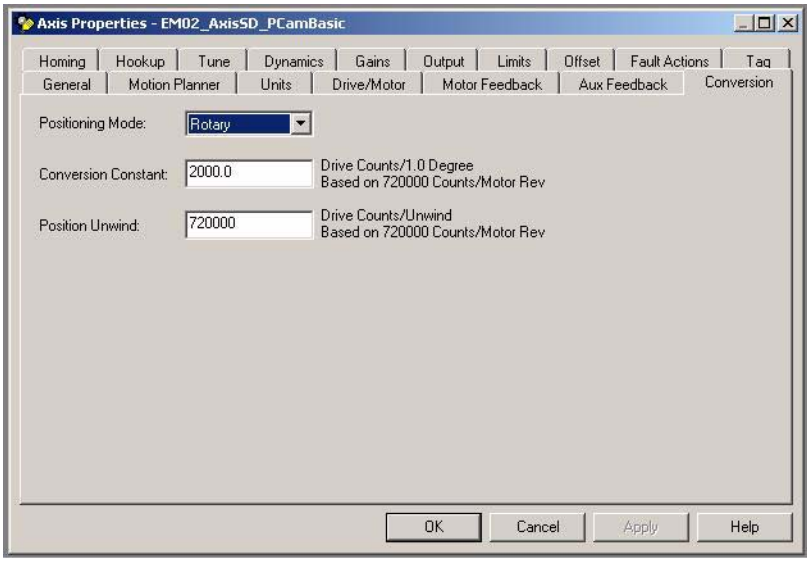
9. Select the Units tab and edit default values as appropriate for your application.



10. Select the Conversion tab and edit default values as appropriate for your application.

11. Click OK.

12. Repeat steps 1…11 for each axis module.



For more information on configuring axes, refer to the Motion Modules in Logix5000 Control Systems User Manual, publication LOGIX-UM002.

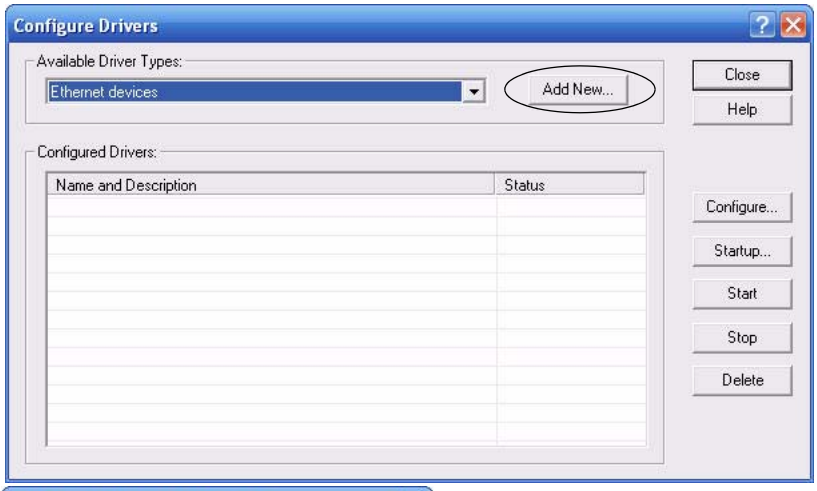
Configure Logix Communications

This procedure assumes that you use the Ethernet protocol to communicate between your computer and the Logix controller, and that your Logix Ethernet module has already been configured. For additional information on configuring Logix communications, see the ControlLogix Controllers User Manual, publication 1756-UM001.

Follow these steps to configure Logix Communications.

1. Open the RSLinx Classic software and select Configure Drivers in the Communications menu.

   The Configure Drivers window opens.

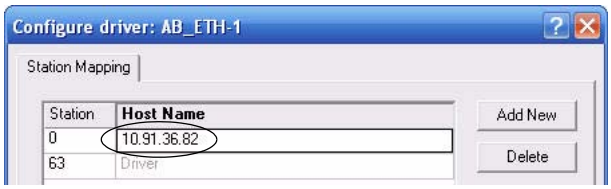


2. From the Available Driver Types drop-down Menu, select the Ethernet Devices driver, and then click Add New.

   The Add New RSLinx Classic Driver window opens.

3. Name the new driver, and then click OK.

   The Configure driver window opens.



4. Enter the IP address of your Logix Ethernet Module, and then click OK.

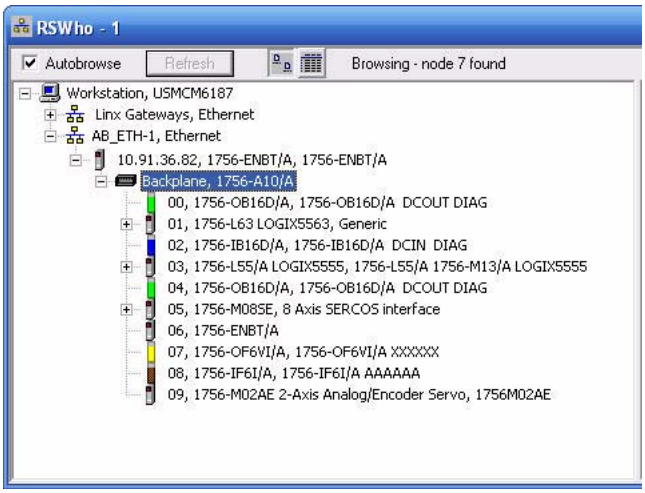
   Note: The IP address shown is an example. Your IP address will be different.

TIP If your Logix Ethernet module is already configured, the IP address is displayed on the module.

5. Click Close in the Configure Drivers window.

6. In the Communication menu, select RSWho.

The RSWho window opens.



7. Expand the 1756-ENBT module until your controller is visible.

8. Verify that you can browse to your Logix controller.

9. Minimize the RSLinx application window and return to your RSLogix 5000 project window.

Save and Download Your Program

After completing the Logix configuration, you must download your program to the Logix controller.

Follow these steps to save and download your program.

1. On the RSLogix 5000 toolbar, click the Verify Controller button.

   The system verifies your Logix controller program and displays errors and warnings.

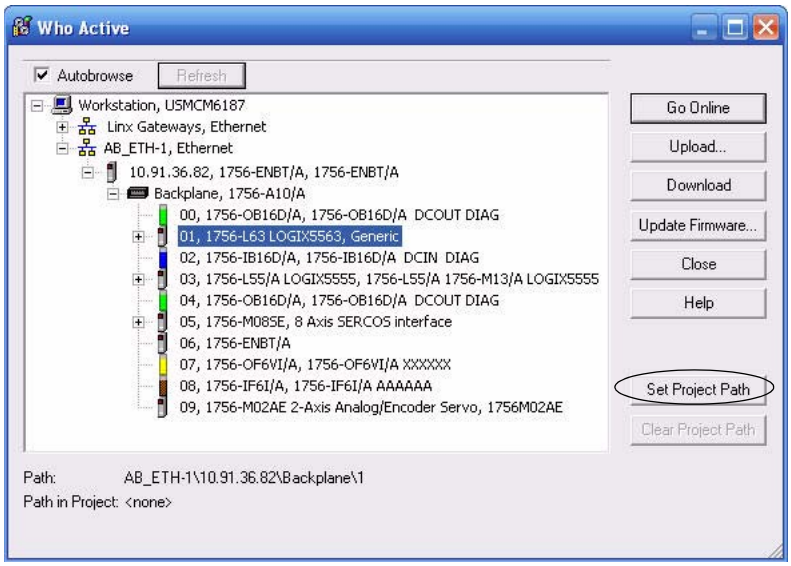
2. On the File menu, select Save As to save the file.

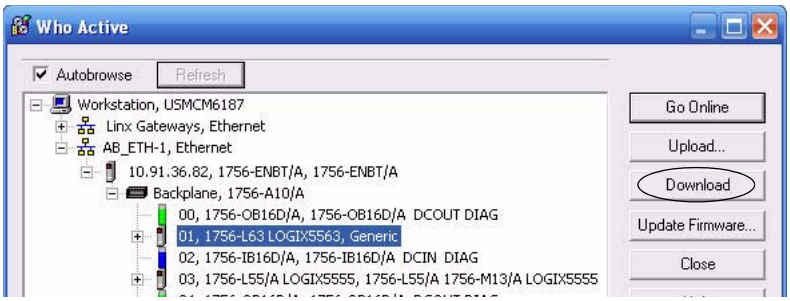
3. In the Communications menu, select Who Active.

   The Who Active window opens.

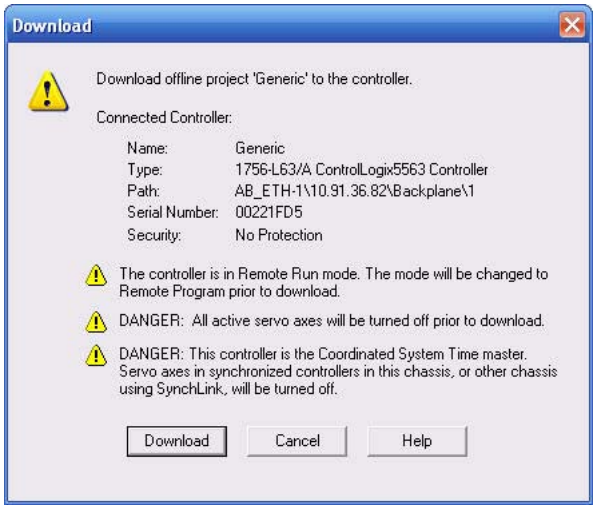
4. Browse to your Logix controller and click Set Project Path.

5. Verify that the key switch on your controller module is in the REM (remote) position, and then click Download.





The Download window opens.



6. Click Download to send the program to the Logix controller.

7. Verify that the three Logix SERCOS module indicators are steady green.

8. Verify that the Kinetix drive seven-segment indicator has reached phase 4.

   If steps 6 or 8 fail, refer to the Kinetix 6000 Multi-axis Servo Drives User Manual, publication 2094-UM001, for troubleshooting tables.

ATTENTION

To reduce the possibility of unpredictable motor response, disconnect all loads from your motors until initial axis tuning is complete. For tuning procedure, refer to the Kinetix 6000 Multi-axis Servo Drives User Manual, publication 2094-UM001.

Notes:

Motion FactoryTalk View IntegrationLogix Integration

Use the processes in this chapter to configure your FactoryTalk View ME application file. FactoryTalk View ME application files (.apa) are included in the HMI Application Files folder on the Kinetix Accelerator Toolkit DVD.

This chapter also contains instructions for configuring communications, adding axes, testing the project, downloading the program, and running the application.

Before You Begin

- Complete your system hardware selection. (Refer to Chapter 1.)
- Complete your system layout. (Refer to Chapter 2.)
- Complete your system wiring. (Refer to Chapter 3.)
- Complete your Logix Integration procedures. (Refer to Chapter 4.)

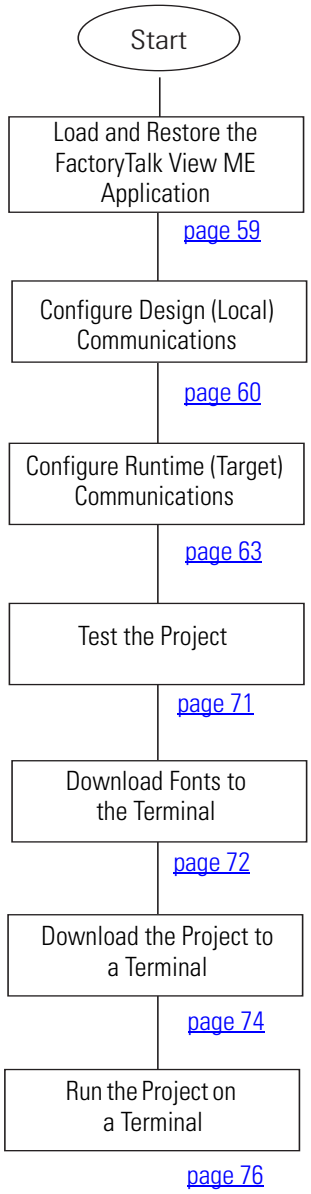
What You Need

- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004
- FactoryTalk View Studio software, version 5.00 or later
- RSLinx Enterprise software, version 2.50 or later
- FactoryTalk View ME application files (PP application file)

  FactoryTalk View ME files are available on the Kinetix Accelerator Toolkit DVD. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.

Follow These Steps

Complete the following steps to configure your FactoryTalk View ME Integrated Motion application.



Select Your FactoryTalk View ME Application File

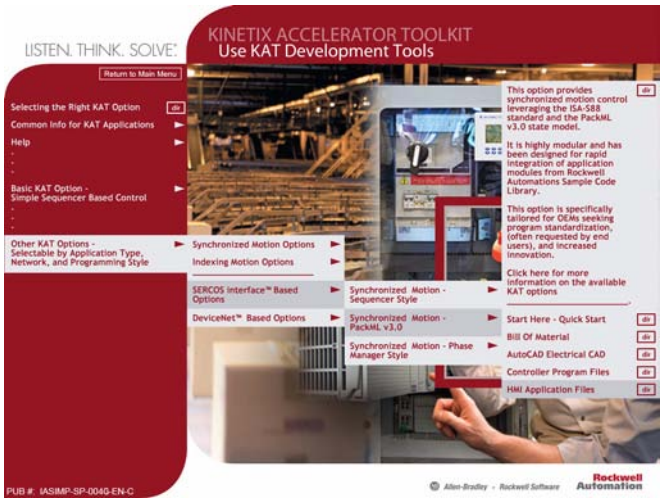
PanelView Terminal	FactoryTalk View ME File Name	Description
PanelView Plus 700/1000	PowerProgramming_V4_00_Core.apa	PanelView Plus 700/1000 terminal pre-configured for one-axis Kinetix 6000 drive system.

Load and Restore the FactoryTalk View ME Application

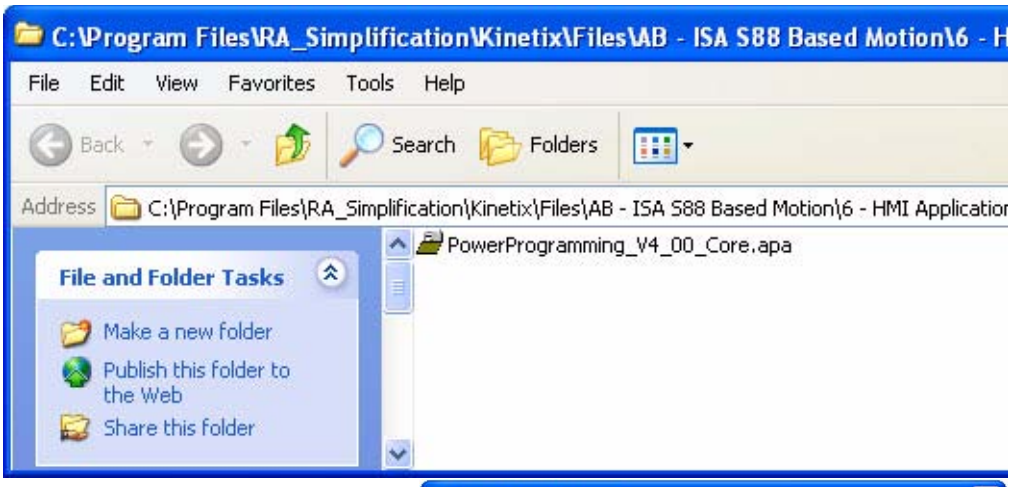
Follow these steps to load and restore the FactoryTalk View ME application file from the Kinetix Accelerator Toolkit DVD.

1. Copy the Kinetix Accelerator Toolkit DVD to your personal computer hard drive.

2. Open the HMI Application Files folder.

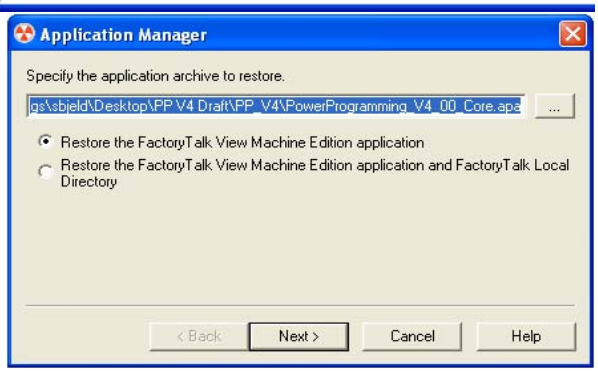


3. Double-click your selected FactoryTalk View ME (.apa) application file.



4. Select PowerProgramming_V4_00_Core.apa.

   The Application Manager window opens.



5. Click to select Restore the FactoryTalk View Machine Edition application button, and then click Next

   Another Application Manager window opens.

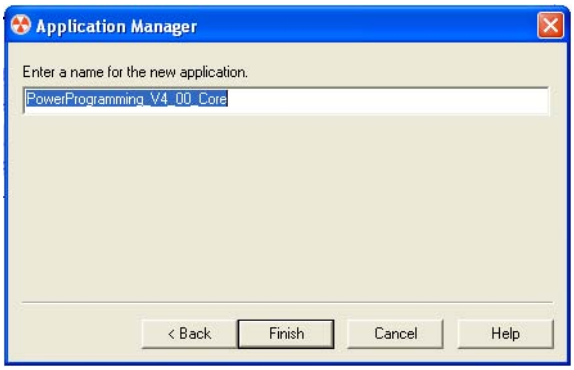
IMPORTANT Selecting Restore the FactoryTalk Machine Edition application and FactoryTalk Local Directory will cause the local security settings on your personal computer to substitute for the security setting from the pre-configured application.

   In this example, the PowerProgramming_V4_00_Core.apa file is selected. Your file name could be different.

   .

6. Click Finish.

   After file restoration is complete, the application closes.



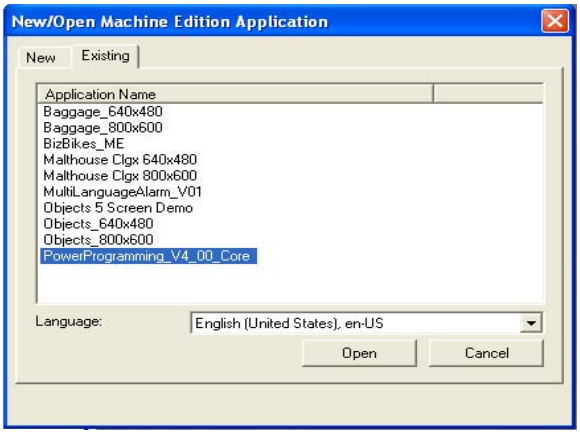
Configure Design (Local) Communications

The Design (Local) tab in Communications Setup reflects the view of the topology from the RSLinx Enterprise server on the development computer. In this example application, the development computer is communicating to the ControlLogix L63 controller via Ethernet network. Other Logix controllers can also be selected.

Follow these steps to configure local communications.

1. Apply power to your Logix controller.
2. Connect your motion system communication network cable to your Logix controller and personal computer.
3. Open the FactoryTalk View Studio software.

   The New/Open Machine Edition Application window opens.



4. Click the Existing tab.
5. Select your FactoryTalk View ME application file.

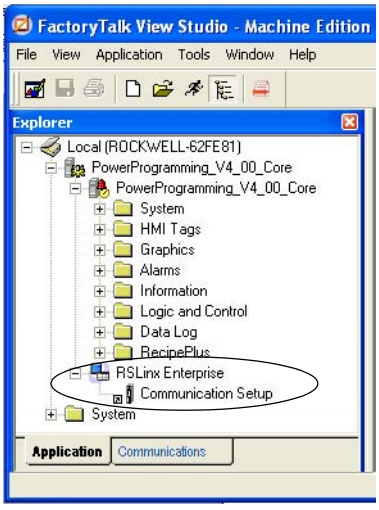
   PowerProgramming_V4_00_Core is used in this example.

6. Click Open.

   The FactoryTalk View Studio - Machine Edition window opens.

7. Expand RSLinx Enterprise in the Explorer window.
8. Double-click Communications Setup.

   The Communications Setup window opens.

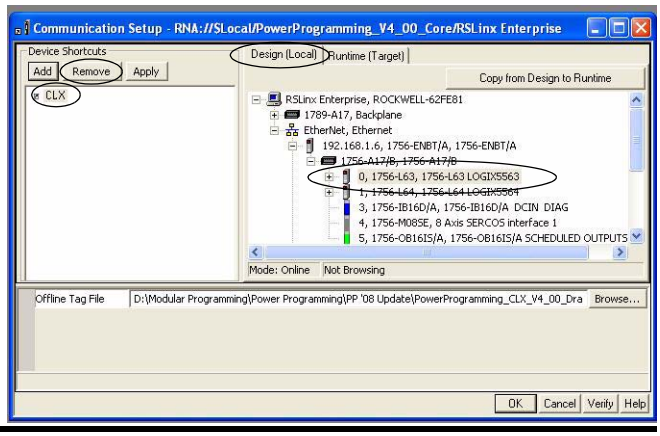


9. In the Communication Setup window, select the Design (Local) tab.

10. Select the CLX device shortcut, and then click Remove.

11. Expand the RSLinx Enterprise tree to gain access to your Logix controller.

0, 1756-L63 is used in this example.

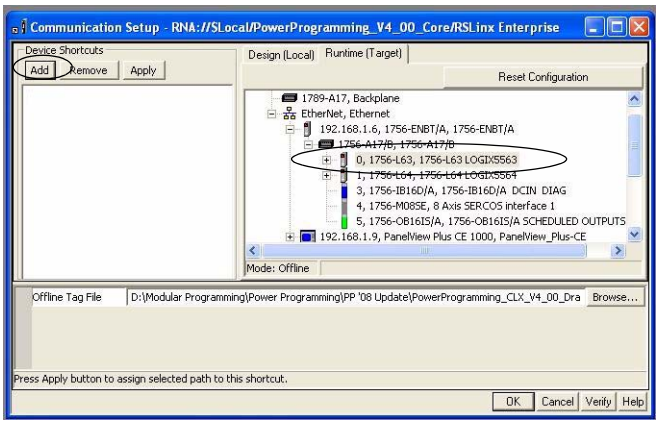


IMPORTANT If the controller is available on the network, RSLinx Enterprise software will autobrowse to it. If RSLinx Enterprise software fails to display your controller, refer to http://www.rockwellautomation.com/solutions/integratedarchitecture/resources4.html and click FactoryTalk View Machine Edition Quick Start Videos.

12. Select your Logix controller.

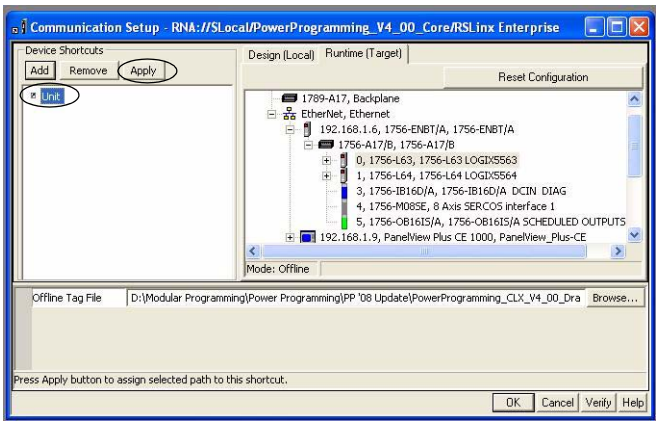
0, 1756-L63 is used in this example. The slot number is 0; your slot number might be different.

13. Click Add in the Device Shortcut window.



14. Enter a unit as the device shortcut name in the Device Shortcut window.

'Unit' is used in this example.



15. In the Device Shortcut window, click Apply.

TIP If you select the device shortcut (Unit), the 1756-L63 ControlLogix controller is highlighted. This indicates that the shortcut is correctly mapped to the controller, and communication exists between your application on the development computer and the controller.

Configure Runtime (Target) Communications

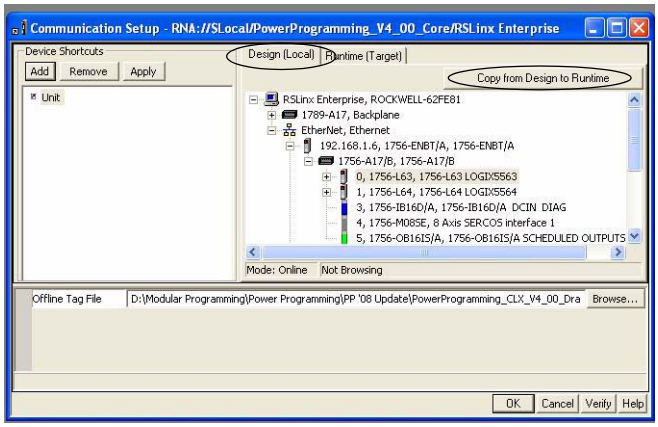
The Runtime (Target) tab displays the offline configuration from the perspective of the device that is running the application and comprises the topology that is loaded into the PanelView Plus terminal. In this example application, the PanelView Plus terminal communicates to the same ControlLogix L63 controller via Ethernet.

Follow these steps to configure Runtime (Target) communications.

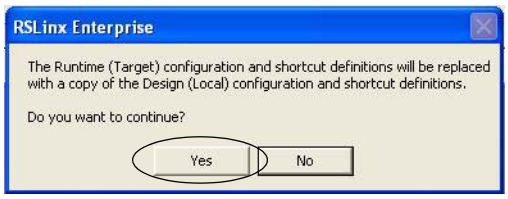
1. In the Communication Setup window, select the Design (Local) tab.

2. Click Copy from Design to Runtime.

   An RSLinx Enterprise message window opens.



3. Click Yes.



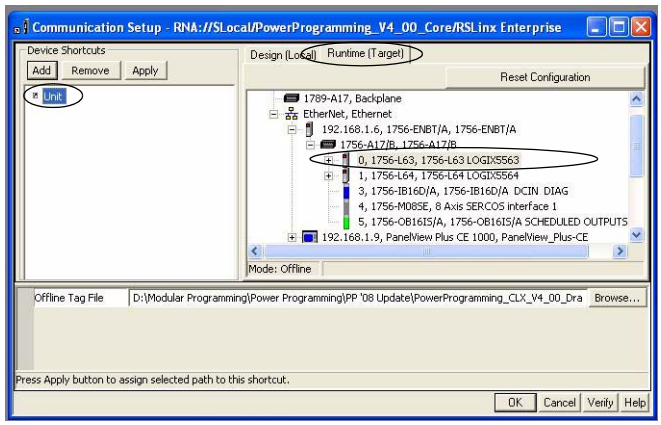
4. Select the Runtime (Target) tab and expand the RSLinx Enterprise tree.

5. Verify that your shortcut name and controller are both highlighted.

   This indicates that communication is established.

   In this example, Unit is the shortcut and 1756-L63 is the controller.

6. Click OK.



Adding EMs to the Project

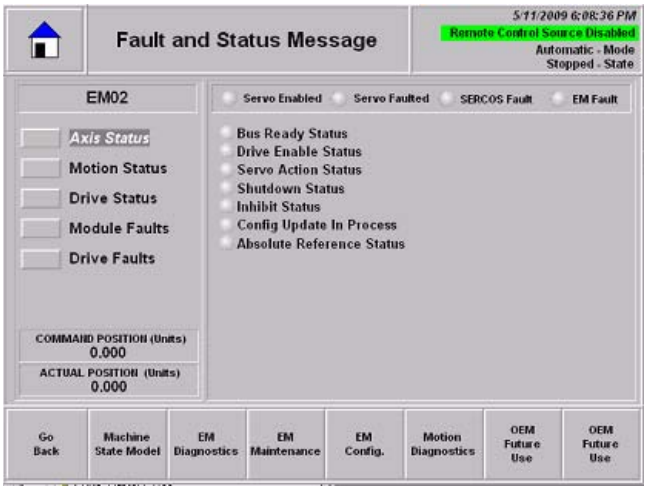
IMPORTANT The template only has one EM defined. If that fits your application needs, skip this section and go to Test the Project on page 71.

The PowerProgramming_V4_00_Core.apa file has one pre-configured virtual axis (EM00) and one servo axis (EM02) for use. In this section, you can add an additional EM (that is, axis) to your Kinetix 6000 (or Kinetix 2000) drive system and to the project file.

Numbering of EMs does not have to be subsequent, so that EM numbers can be given by function to support standardization. FTView will automatically adapt if a module is not present.

All the displays in the project file are parameterized to facilitate quick editing and reuse throughout the application. The following Axis Status display contains faults and status information that is common to all configured axes (from Axis1to Axis*X*).

Axis Status Display



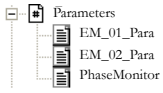
To add a new EM, the following steps are needed.

1. Add (duplicate) a parameter file for an EM and change its placeholder names.
2. Verify that the parameter file for the unit Unit01_Para contains the new EM member.
3. Duplicate and edit an EM diagnostic display file to make a new goto button. Change animation, labels, parameter files, and gotodisplay name.
4. Duplicate and edit an EM configuration display. Add configuration parameters/tags.
5. Make a new goto button on the EM configuration page. Change animation, labels, parameter files, and gotodisplay names.

Add a Parameter File

Follow these steps to add a parameter file to your FactoryTalk View ME application.

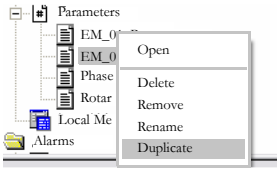
1. Expand the FactoryTalk View ME Explorer window to gain access to Parameters.



2. Double-click Unit01_Para and change the following parameter:
   #10=::[Unit]Program:UN01_ExampleUnit
   to
   #10=::[Unit]Program:UN01_Labeler
   and save the change.

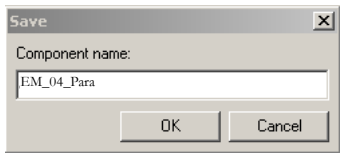
   The parameters list contains the pre-configured axes within the application. Each parameter file is associated with a specific EM (Equipment Module). When opening the Axis Status display, the tag information loads from the EM currently selected.

3. Right-click EM_02_Para status and select Duplicate.



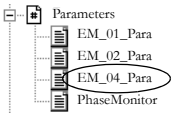
4. Change the Component name from 02 to 03.

   In the pictured example, there is one existing pre-configured axis. Copy, paste, and rename the EM_02_Para parameter file. The new name is EM_03_Para; the new name of your renamed parameter file could be different.



5. Click OK.

6. Double-click the EM_03_Para status parameter file created in step 5.



   The EM_03_Para - PowerProgramming_V4_00_Core/Parameters window opens.

   In each parameter file, there are nine references to specific tags or partial strings. The ! before any text indicates that line is a comment. The # before a number indicates a parameterized tag.

   Parameter #01 contains the alias the Topic Name (Unit in this example). This should match the shortcut name created in step 14 on page 62.

   Parameter #02 is used to alias the Motion Group name.

   Parameter #03 is used to alias the Unit program.

   Parameter #04 is used to alias the State Machine AOI backing tag in controller scope.

Parameter #05 is used to alias the axis tag.

Parameter #06 is used for displaying the EM name on the screen. (HMI Tag - 30 EMs are predefined in the database.)

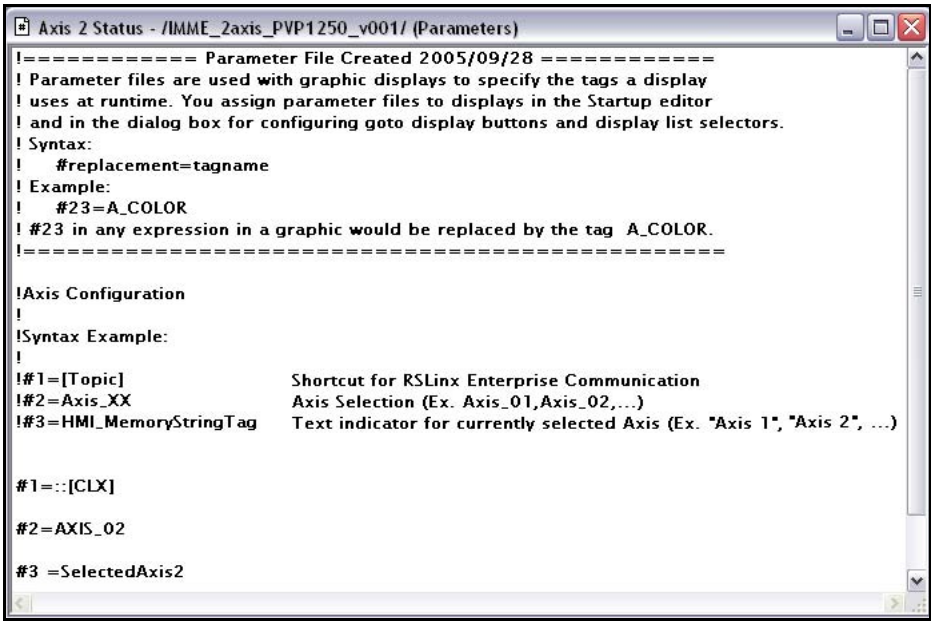
Parameter #07 is used for On-Line Cam Calculation Program.

Parameter #09 is used to alias the UN01 tag in controller scope.

Parameter #10 is used to alias the EM program name.

7. Edit Parameter #03 and change
   #03=::[Unit]Program:UN01_ExampleUnit
   to
   #03=::[Unit]Program:UN01_Labeler.

8. Edit parameters #05, #06, #07 and #10, and change tag names with EM02 to EM03 if the same naming convention is used.



In this example:

- #05=::[Unit]Program:EM02_PCamBasic.Axis1

  becomes

  #05=::[Unit]Program:EM03_Conveyor.Axis1
- #06= EM02

  becomes

  #06= EM03
- #07=::[Unit]Program:EM02_CAM_Type10_1

  becomes

  #07=::[Unit]Program:EM03_CAM_Type10_1
- #10=::[Unit]Program:EM02_PCamBasic

  becomes

  #10=::[Unit]Program:EM03_Conveyor

9. From the File menu, select Save.

10. Repeat steps 3…9 as necessary for your axis count.

The pre-configured application files include HMI tags for up to 30 axes. The following table indicates how to add HMIs.

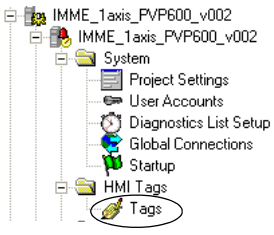
If your axis count is	Then go to
30 or less	Edit Display Files on page 68.
31 or more	Add an HMI Tag on page 67.

Add an HMI Tag

In this section, you create an HMI string tag for each parameter file #6 (Axis 30 Status or greater) that you created in Add a Parameter File section.

Follow these steps to add an HMI tag to your FactoryTalk View ME application.

1. In the Explorer window, expand your application file.

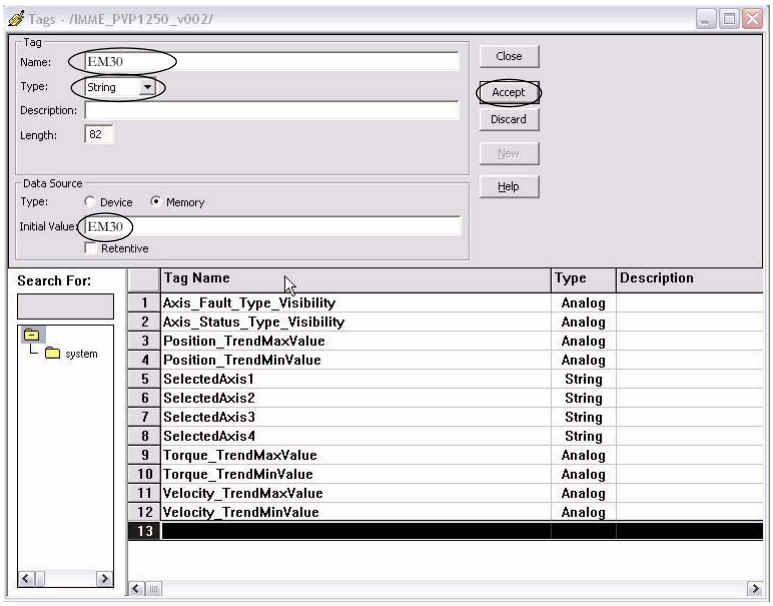


2. Double-click Tags.

The Tags editor window opens.

3. Click the first empty row in the Tags editor window.

Row 41 is used in this example. Yours could be different.



4. Type EM*xx* in the Name field.

EM30 is used in this example. Yours could be different.

5. Select String from the pull-down menu in the Tag Type field.

6. Select Memory in the Data Source Type field.

7. Enter EM*xx* in the Initial Value field.

This is the text that is displayed on the graphic display. EM30 is used in this example. Yours could be different.

8. Click Accept. Leave default values for Description and Length as they are.

9. Repeat steps 3…8 for each newly-created parameter file #6 (EM30 or greater).

10. Click the Close button <X> in the Axis *x* Status parameter file window to close the window.

Edit Display Files

Follow these steps to edit the display files.

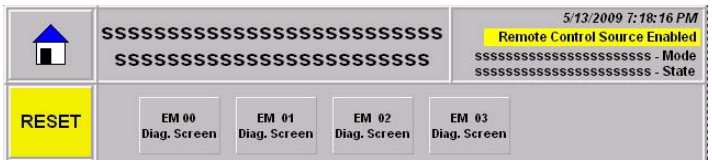
1. Return to the Explorer window and expand the Displays editor.

In this example, the displays shown here are visible.
Yours could be different.

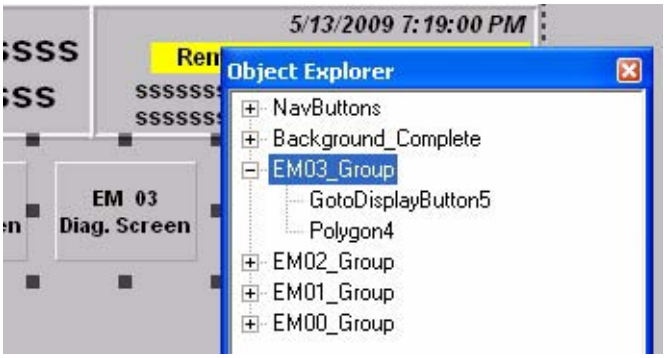
2. Duplicate the display SI02_EM_02 and rename it to SIxx_EM_xx, where xx is the EM number (for example, EM03 will give S103_EM_03; EM10 will give S110_EM_10, and so on).

The Axis Selection display screen opens.

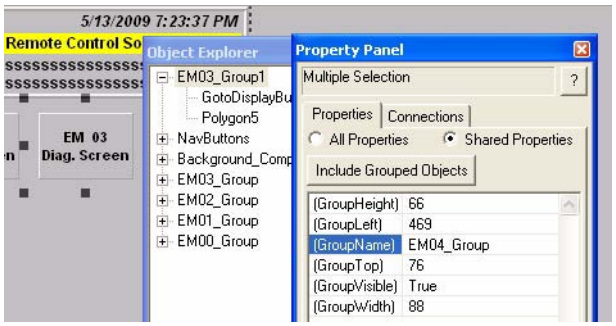
The EM status display is called from S100_EM_Diagnostics and has buttons for four EMs predefined as EM00 to EM03. Each button is controlled with visibility, so only EMs defined in the PAC program will be shown.



Each button is a group containing a polygon and a goto display button. The polygon will change color if a fault is present and the goto display button will open the EM status display.

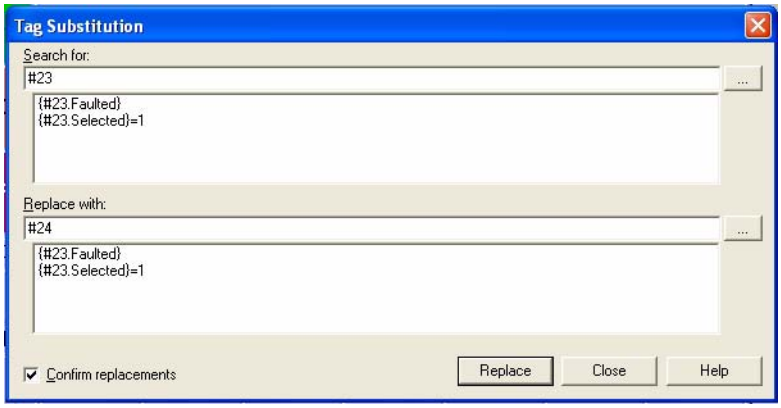


3. Copy the group EM02_Group and use the property panel to rename the group to EM03_Group.



4. Change the animation of the group from #22.Selected to #23.Selected. Right-click on the group and press hot keys Ctrl+R.

   The tag substitution display opens.



5. In the Search for field, type the placeholder to be substituted. In the Replace with field, type the new placeholder number (in this example, substitute #22 with #23). Click Replace and Replace All, and OK to submit the change.

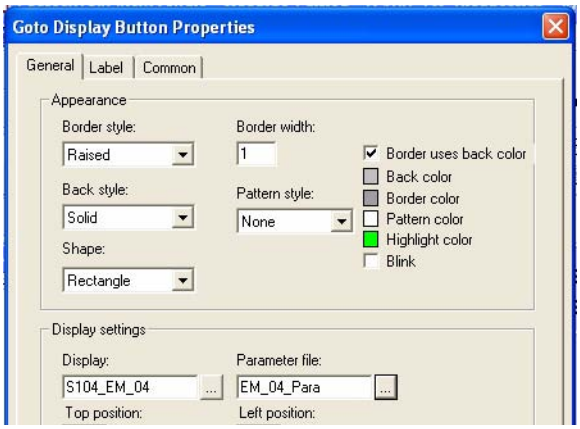
The placeholder #*xx* can be found in the parameter file Unit01_Para that has 30 predefined EMs (EM00 to EM29).

- #20 corresponds to EM00.
- #21 corresponds to EM01.

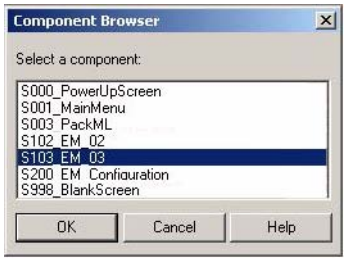
  …
- #49 corresponds to EM29.

6. Now use the object explorer to edit the GotoDisplay button. In Display settings, click the … button and browse for the newly-created display and corresponding parameter file.

The Component Browser window opens for either of the two.



7. Choose S103_EM_03 as the display to go to and EM_03_Para as the corresponding parameter file.

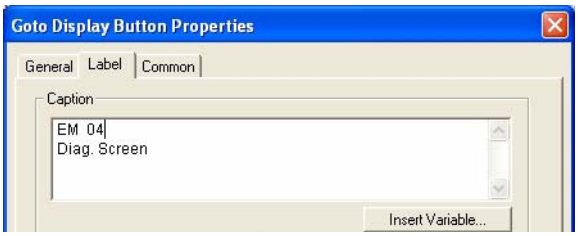


8. Click OK.

9. Return to the Goto Display Button Properties window and select the Label tab.

10. Edit the text in the Caption field. Go to the Label pane and change the text to EM 03 Diag Screen.

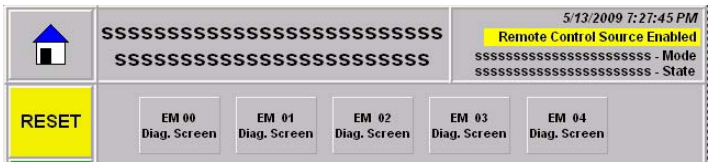
In this example, EM 03 Diag. Screen becomes EM 03 Diag. Screen.



11. Click OK.

The Goto Display Button Properties window closes.

12. Verify that EM Diagnostic now includes your new EM (EM03 in this example).



13. Duplicate the display S202_EM02_Configuration and rename it to S2xx_EMxx_Configuration where xx is the EM number. (For example, EM03 will give S203_EM03_Configuration, EM10 will give S210_EM10_Configuration, and so on.)

14. The EM configuration display is called from S200_EM_Configuration and has buttons for four predefined EMs: EM00 EM03. Each button is controlled with visibility, so only EMs defined in the PAC program will be shown. Use the procedure in Steps 3 12 to copy the button and make the required changes.

15. Repeat steps 1…12 for each new EM.

Using Multiple Languages in the Project

Currently the application only supports English language.

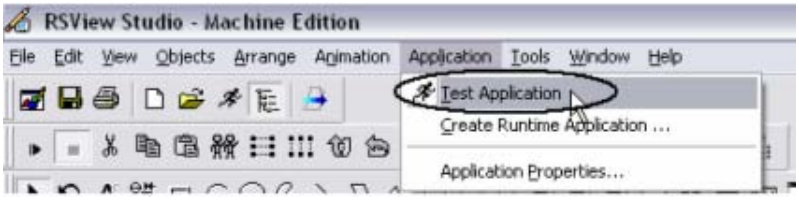
Test the Project

FactoryTalk View Studio lets you create and test individual displays or the entire project, so that you can navigate and test all the functionality before downloading your project to a terminal.

IMPORTANT To test run the project, all communications must be configured first.

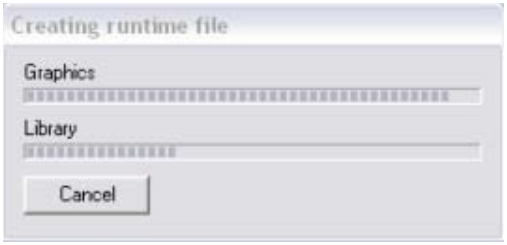
Follow these steps to test your FactoryTalk View Studio project.

1. Select Test Application in the Application menu.



2. If prompted to save changes, click Yes.

The FactoryTalk View Studio software compiles the project and runs it as if it were executing on the desired terminal.



3. Test the functionality of the project and fix errors as necessary.

4. Click Close [F3] to close this window.

5. When the test of the application is done, press Enter >x< from the keyboard to end testing and shut down the application.

Download Fonts to the Terminal

Because PanelView Plus terminals do not include the Arial Bold font when shipped, and the FactoryTalk View ME applications require this font, it is necessary to download Arial Bold from your personal computer to the PanelView Plus terminal.

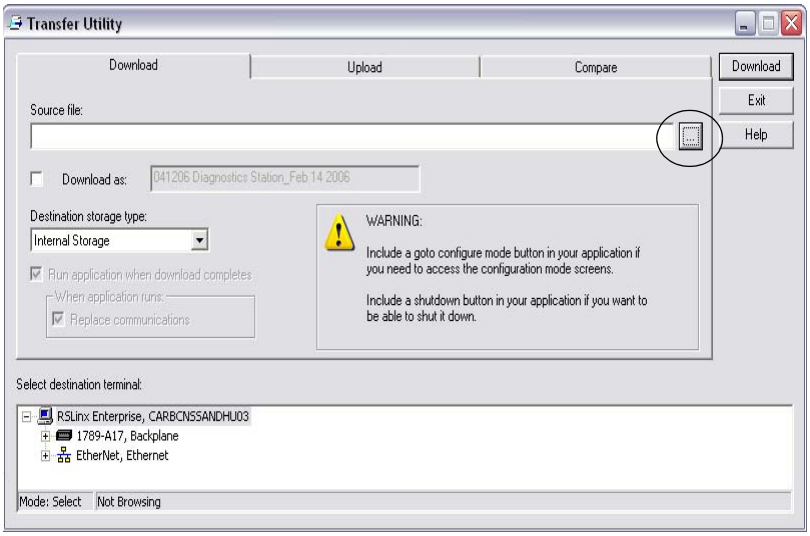
Follow these steps to download fonts to the PanelView Plus terminal.

1. Apply power to the PanelView Plus terminal.

2. Connect your Ethernet cable between your PanelView Plus terminal and personal computer.

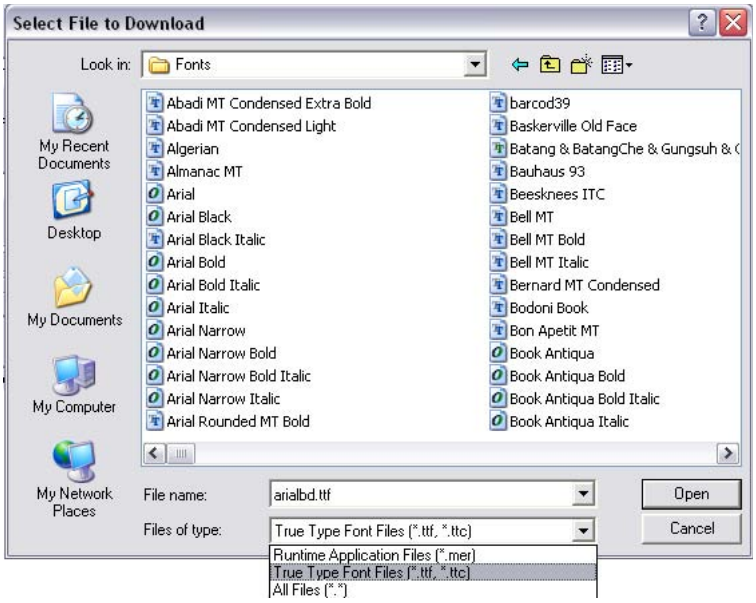
3. Select Transfer Utility from the Tools pull-down menu.

The Transfer Utility window opens.



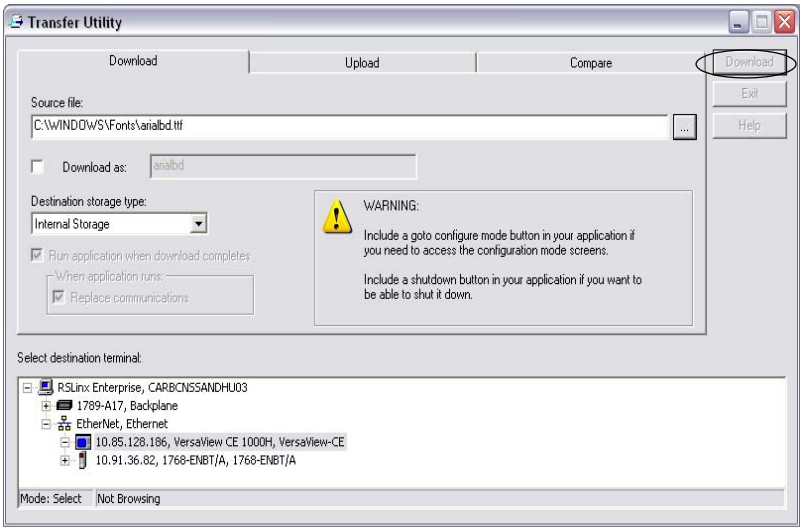
4. Click … to browse for the source font file.

The Select File to Download window opens.



5. Navigate to C:\WINDOWS\Fonts.
6. Select True Type Font Files in the Files of type field.
7. In the File name field, enter Arialbd.ttf.
8. Click Open.

The Transfer Utility window returns.



9. Expand the Ethernet, Ethernet driver.
10. Select your PanelView Plus terminal.
11. Click Download.

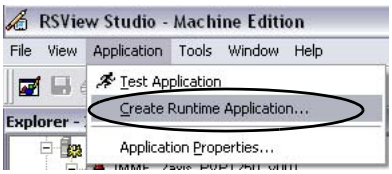
The font transfers to the terminal.

Download the Project to a Terminal

Follow these steps to download your FactoryTalk View Studio project.

1. Select Create Runtime Application in the Application menu.

   The Create Runtime Application window opens.

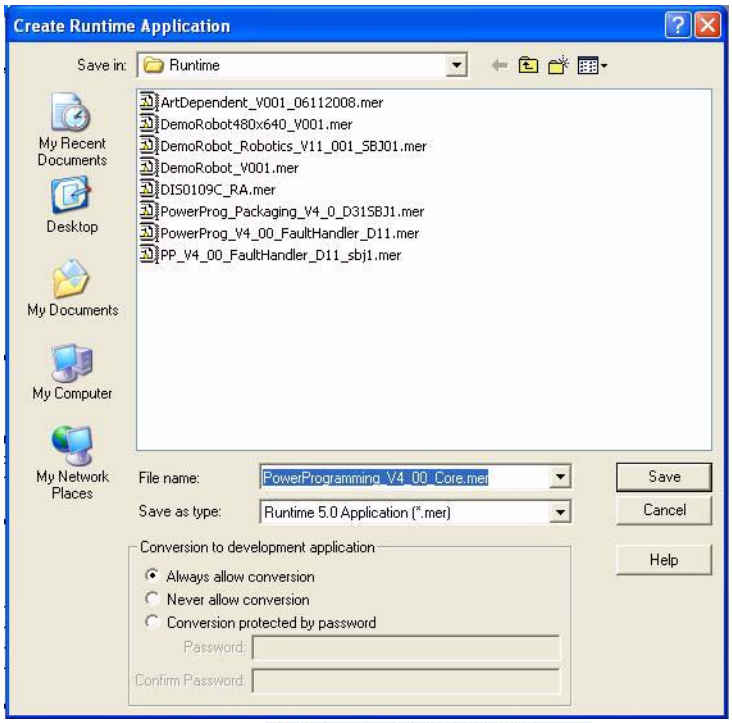


2. Select Runtime 5.0 Application (*.mer) for Save as type.

3. Enter a file name for the application.

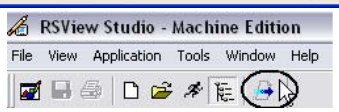
   PowerProgramming_V4_00_Core.mer is used in this example.

4. Click Save.

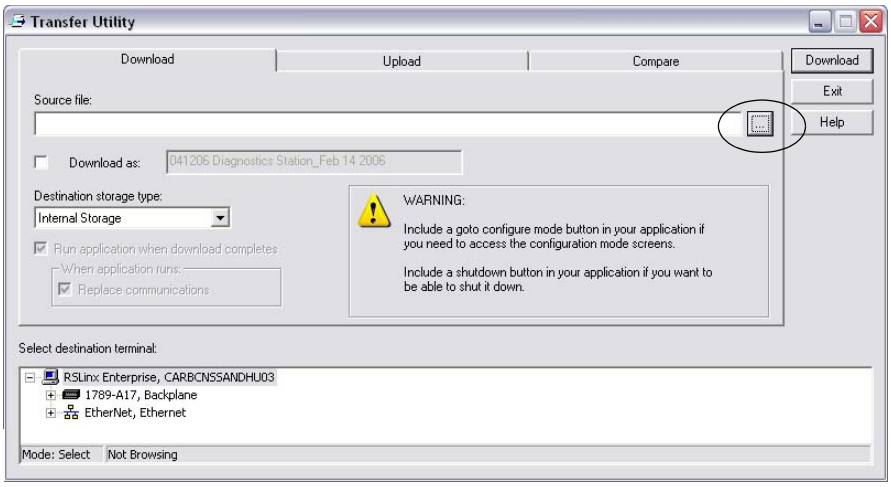


5. From the toolbar, click the File Transfer Utility button.

   The Transfer Utility window opens.

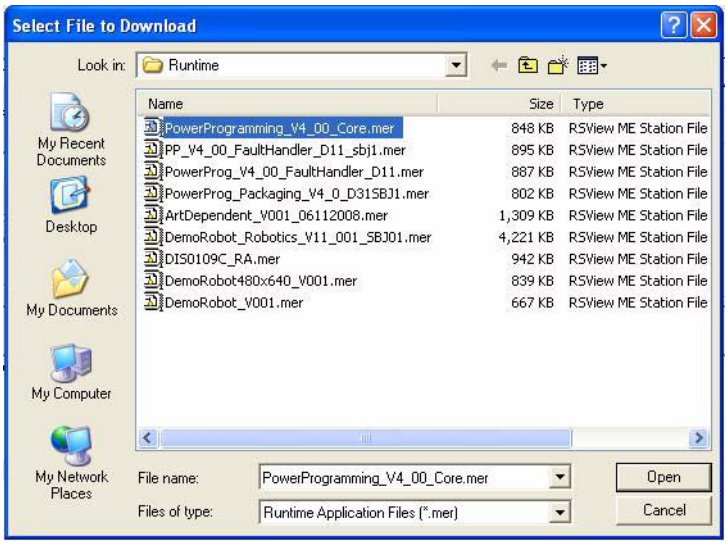


6. Click … to browse for the runtime file.



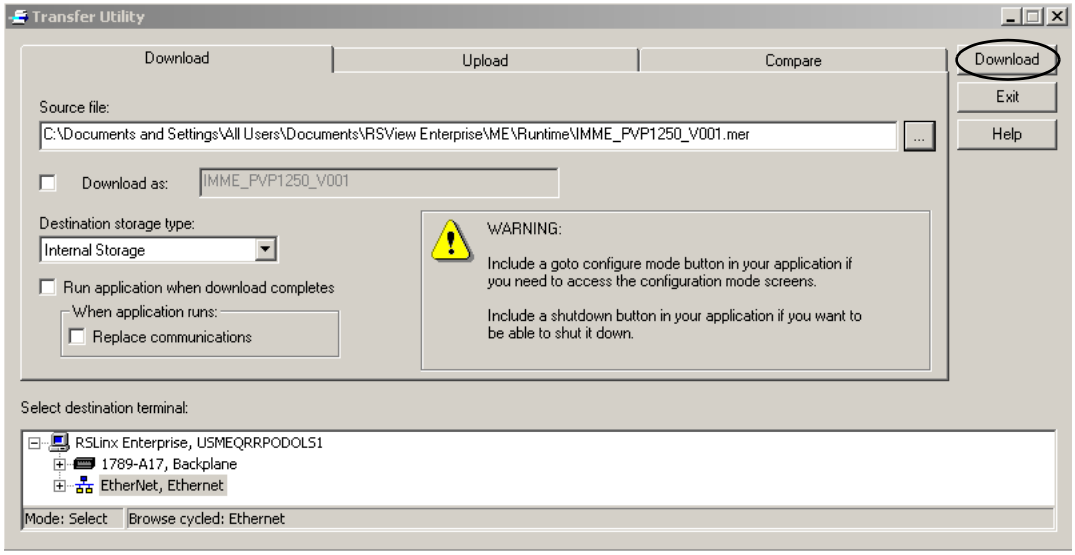
7. Select PowerProgramming_V4_00_Core.mer, and then click Open.

8. Browse for your PanelView Plus terminal.



9. Select Download.

   The file transfers to the PanelView Plus terminal.



10. Click OK when prompted.

11. Click Exit to close the Transfer Utility window.

12. From the File menu, select Close to close the application.

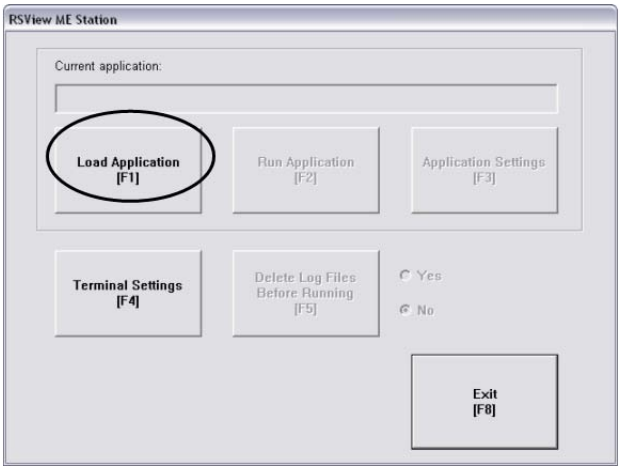
Run the Project on a Terminal

Follow these steps to run your project on the PanelView Plus terminal.

1. Apply power to the PanelView Plus terminal.

2. Connect your motion system communication network cable to your PanelView Plus terminal and personal computer.

The FactoryTalk View ME Station window opens.



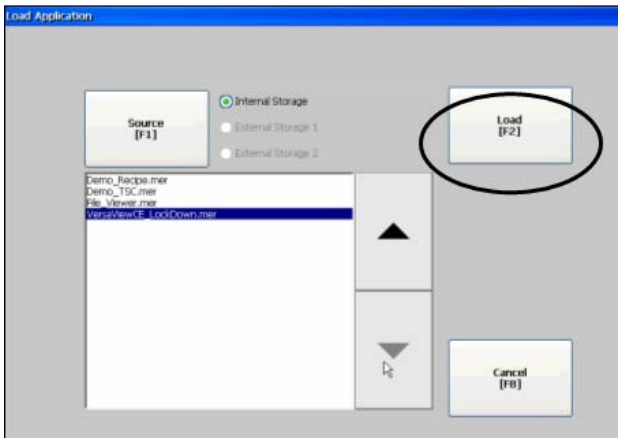
3. Click Load Application.

The Load Application window opens.

4. Scroll through the list of application files by using the up/down arrows and select the .mer file you intend to run.

PowerProgramming_V4_00_Core.mer is used in this example.

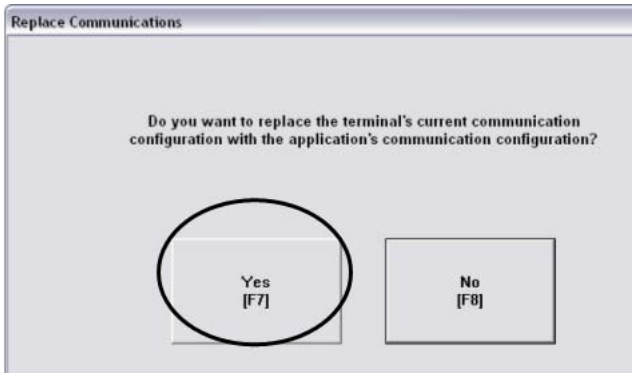
5. Click Load.



The Replace Communications window opens.

6. Click Yes.

If you click No, the communications settings from the project run previously will be used instead.



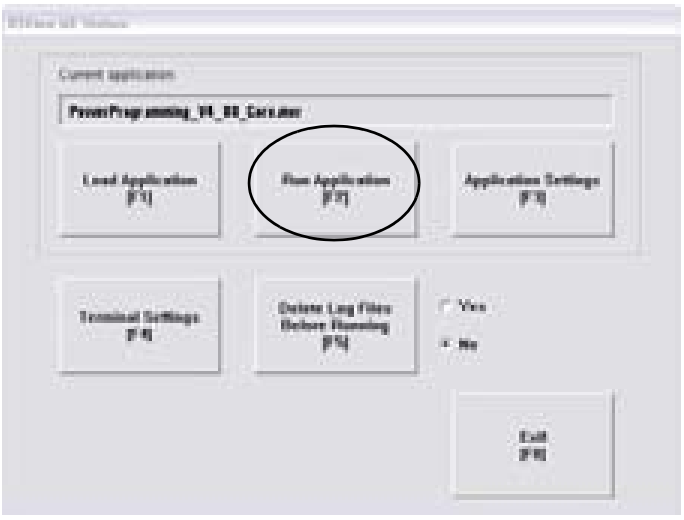
The FactoryTalk View ME Station window returns.

7. Verify that the PowerProgramming_V4_00_Core.mer file appears in the Current application field.

8. Click Run Application.

9. Verify the functionality of the application.

Refer to Chapter 6 for a basic understanding of how to run a general motion system application.



Motion System Application Guide

In this chapter, you are guided through the pre-configured FactoryTalk View ME application that interfaces with the pre-configured Logix program that controls your base motion system. You will run your motion system in Manual mode and Automatic mode, and use the built-in axis status and diagnostics.

Before You Begin

- Complete your system hardware selection. (Refer to Chapter 1.)
- Complete your system layout. (Refer to Chapter 2.)
- Complete your system wiring. (Refer to Chapter 3.)
- Complete your Logix Integration procedures (refer to Chapter 4) and download the Logix program to your controller.
- Complete your FactoryTalk View ME Integration procedures (refer to Chapter 5) and download the FactoryTalk View program to your HMI.

ATTENTION

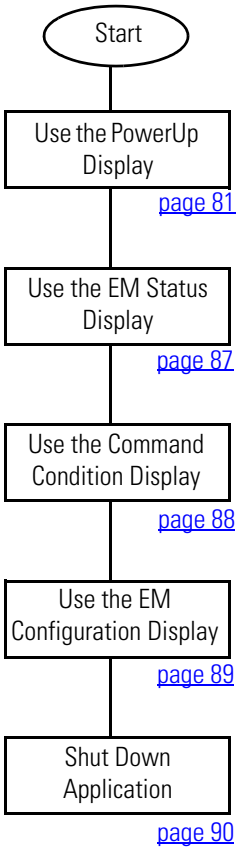
To reduce the possibility of unpredictable motor response, disconnect all loads from your motors until initial axis tuning is complete. For tuning procedure, refer to the Kinetix servo drive user manual for your system, listed in What You Need on page 79.

What You Need

- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.
- Hardware installation and wiring complete, with power applied.
- Motion Logix application file (PowerProgramming_CLX_V4_00_Core.ACD) downloaded to ControlLogix or CompactLogix controller. Controller is set to run.
- FactoryTalk View ME runtime application file (PowerProgramming_CLX_V4_00_Core.mer) downloaded to the PanelView Plus terminal. Run Application activated on terminal.
- Kinetix 2000 Multi-axis Servo Drive User Manual, publication 2093-UM001.
- Kinetix 6000 Multi-axis Servo Drive User Manual, publication 2094-UM001.
- Kinetix 7000 High Power Servo Drive User Manual, publication 2099-UM001.

Follow These Steps

Complete the following display overview steps to run the pre-configured application and gain an understanding of the general motion system operation.



Use the PowerUp Display

With power applied to your Kinetix Integrated Motion system, and the Logix controller and PanelView Plus terminal in Run mode, the PowerUp display automatically opens on your PanelView Plus terminal.

IMPORTANT If the PowerUp display is not visible or errors are reported on either the Logix controller or PanelView Plus terminal, refer to previous chapters to check system wiring and configuration settings.

The PowerUp display is meant to display your design. You can change this display to include items such as your company logo, machine name, picture of machine.

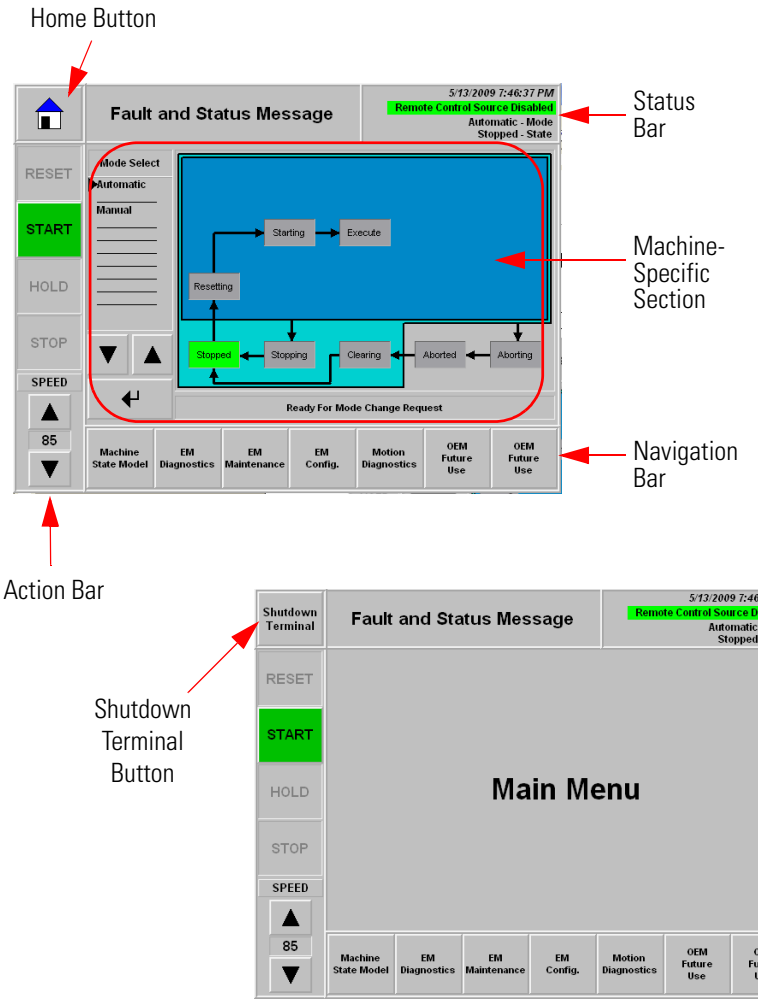
Press anywhere on the screen to continue.

General Display Layout

The general layout of the displays can be divided into four sections.

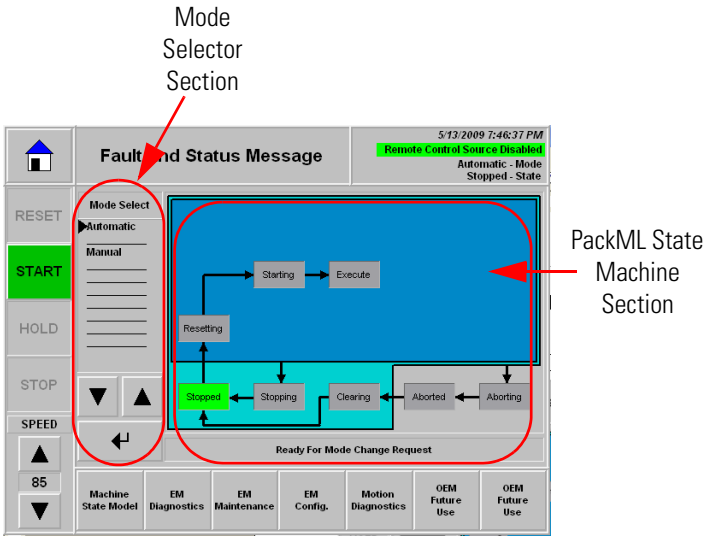
- Navigation bar - Navigation buttons to go to various displays.
- Action bar - Reset, Start, Hold, Stop and ramp speed up/down. The buttons will be unavailable if the actual state of the state machine does not allow the action.
- Status bar - Fault and Status Message and mode-specific information.
- Space for machine-specific items - for example, a picture of the machine with indicators.

The Home button is located in the upper left corner, which makes it possible to return to the Main Menu from every display. The only exception is on the Main Menu display, which is where the Home button on other displays takes you. On the Main Menu display, instead of a Home button, there is a Shutdown Terminal button that will terminate the application and put the panel into configuration mode. (Refer to *Shut Down Application* on page 90 for details about the Shutdown Terminal function.)



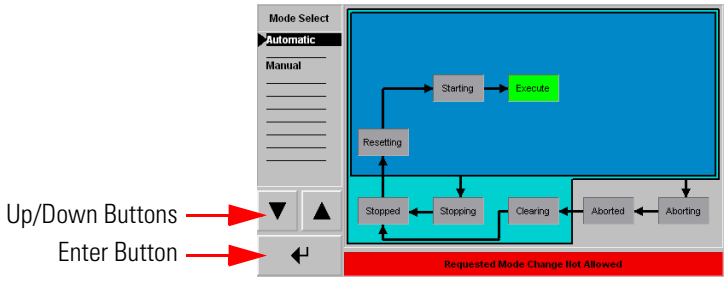
Machine State Model Display

The Machine State Model display consists of two sections: a PackML State Machine section and a Mode Selector section.



Mode Selector Section

The template has two predefined modes: Automatic and Manual. It is possible to change between the two modes. Use the Up/Down buttons to scroll through the mode list. Use the Enter button to choose a mode.

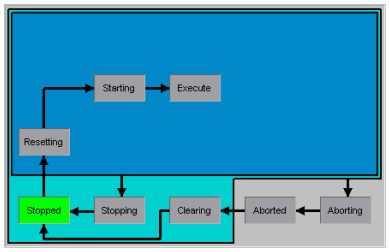


If you try to change mode in a state that does not allow a mode change, you will be notified by a red bar with the text: 'Requested Mode Change Not Allowed'. The figure shows a request for Automatic mode while the state machine is in Execute state in Manual mode.

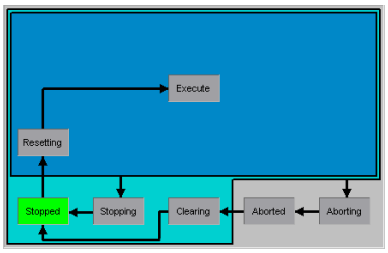
State Machine Section

In the state machine, an active state is indicated with a green background. In the figure below, the Stopped state is active. The AOI controlling the state machine can be configured to use all 17 states of the PackML V3.0 State Machine; however the template only utilizes some of them.

Automatic Mode uses these states: Aborting, Aborted, Clearing, Stopping, Stopped, Resetting, Starting, and Execute.



Manual Mode uses these states: Aborting, Aborted, Clearing, Stopping, Stopped, Resetting, and Execute.



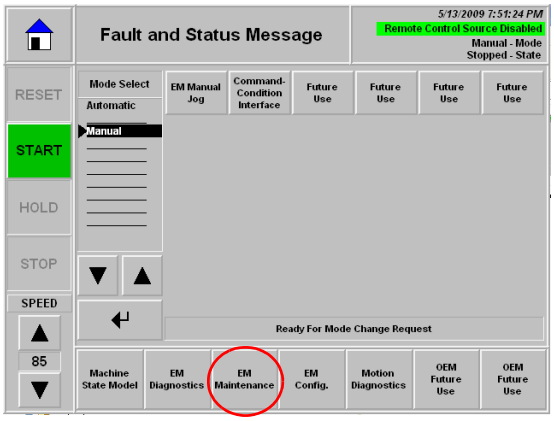
Manual Mode (EM Manual Jog)

In Manual mode, the template allows each individual axis to be jogged.

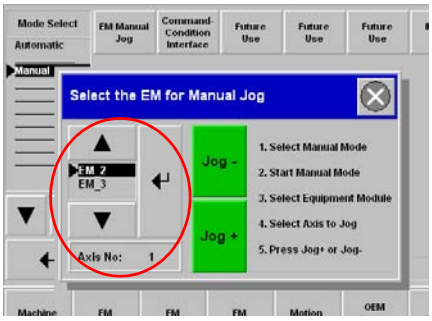
Follow these steps to jog the selected axis using the EM Manual Jog display.

1. Navigate to the EM Maintenance display by pressing EM Maintenance on the Application Navigation Bar.
2. To make sure the machine is in Manual mode and Execute state, press Start in Manual mode.

   The state transitions from Stopped to Resetting and then to Execute and the servo system will be enabled and all axes will have feedback on.



3. Open the EM Manual Jog popup by pressing EM Manual Jog.
4. Scroll up/down in the list, select the EM, and key in the axis number that must be jogged.
5. Now use the Jog- and Jog+ to jog in either direction.

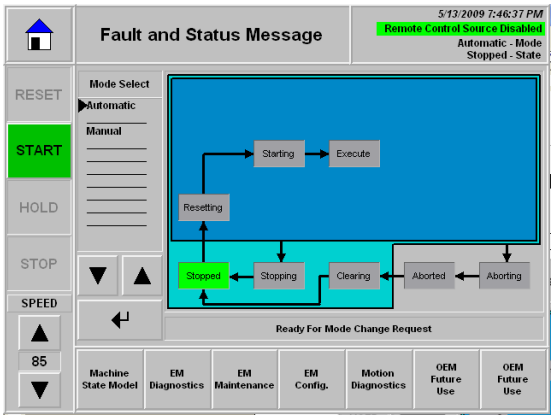


ATTENTION

Before running jog on an axis, make sure that it is configured correctly. Refer to Motion Logix Integration on page 35 for details.

Automatic Mode

Navigate to any display where the action buttons are present, for example, the Machine State Model display. Use the Mode Selector to put the machine in Automatic mode. (This can only be done if it is in Stopped state).



The Automatic mode lets you start, stop, and reset the motion system.

'Resetting', 'Starting', and 'Execute' State Actions

To start your motion system and proceed to Execute state, press Start.

ATTENTION

Pressing Start will cause the system to move.

Do not press Start if motion will cause personal injury or damage to equipment.

Prior to entering Execute state, the machine will enter a Resetting state where it will enable, home, prepare for execution, and continue to the Starting state where it will start execution.

The state (green) moves from Stopped to Resetting, Starting, and then to the Execute state and the motion system axes begin operating according to the Logix program.

'Stopping' State Actions

To stop your motion system, press Stop. The machine will stop all motion and disable all axes.

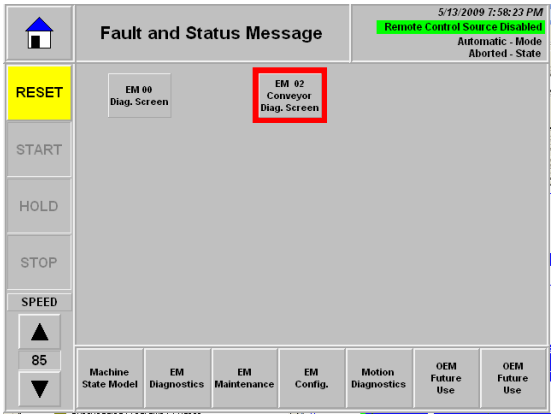
The state (green) moves from Resetting, Starting or Execute, to Stopping and then to Stopped.

ATTENTION

The Start and Stop buttons on your PanelView Plus terminal display do not replace a hardwired start/stop control circuit for safety purposes. Your motion system should also have an emergency start/stop control circuit.

'Aborting' and 'Clearing' State Actions

If the unit has faulted (for example, with an emergency stop or a servo drive fault) the state machine will make a transition to the Aborting state where all axes will be disabled. When Aborting is done, it will transition to Aborted. The state moves from Resetting to Starting, Execute, Stopping, Stopped, Aborting, and then to Aborted.



In this picture, EM02 is faulted (indicated with a red border) and the machine is in the Aborted state. Note also that only the Reset button is visible since it is the only valid action when the machine is aborted.

To recover from Aborted, press Reset. This will initiate the Clearing state where faults will be reset. When all faults are reset, it will transition to Stopped state. The state (green) moves from Aborted to Clearing and then to Stopped.

Adjust the Speed

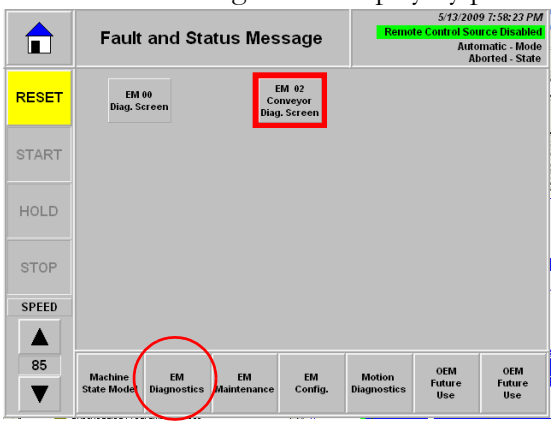
To adjust the relative speed of your motion system, use the speed selector. This is found in the action bar located on the lower left side on displays with main control. Use the ramp up/down buttons to change speed. The minimum speed is 10% and the maximum is 100%.

Use the EM Status Display

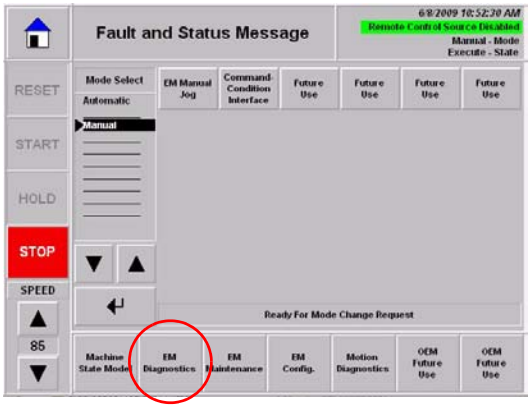
The EM Status display lets you view drive status and faults, as well as general motion and axis, both when the system is in aborted state and not in aborted state.

Follow these steps to view status and fault indicators and to select the axis.

1. Go to the EM Diagnostics display by pressing EM Diagnostics.

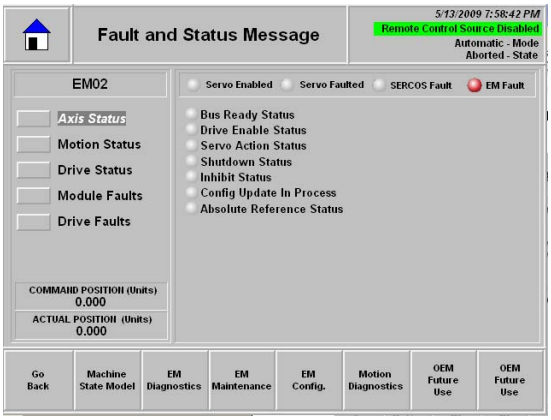


System in Aborted State

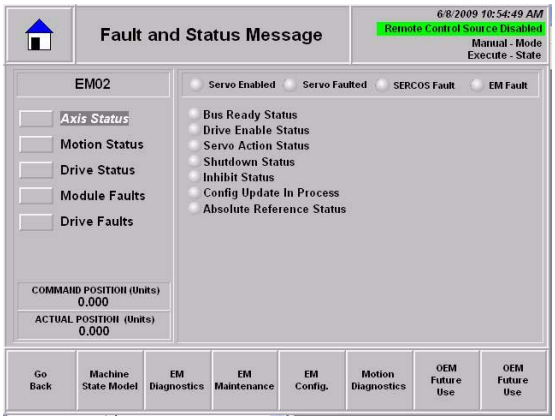


System in Execute State

2. Press EM02.
   The Axis Status display opens.



System in Aborted State



System in Execute State

3. Select a system status or fault category from the left pane. (You can press either the text or its corresponding button.)

   The selected object is indicated by a dark grey background and italic text. The figures above show the Axis Status.

4. Monitor the status or fault indicators.

   In this example, Axis Status indicators are shown. Servo Enabled, Servo Faulted, SERCOS Fault, and EM Fault status indicators are always present.

   Motion Status and Module Faults indicators represent general system status/fault conditions. Axis Status, Drive Status, and Drive Faults indicators show the corresponding status/faults of the axis displayed on the Axis Select button.

   The ON and OFF and Faulted and Non-Faulted states are described in the tables below.

Status Indicators	ON State	OFF State
Axis Status	Green	Grey
Drive Status		
Motion Status		

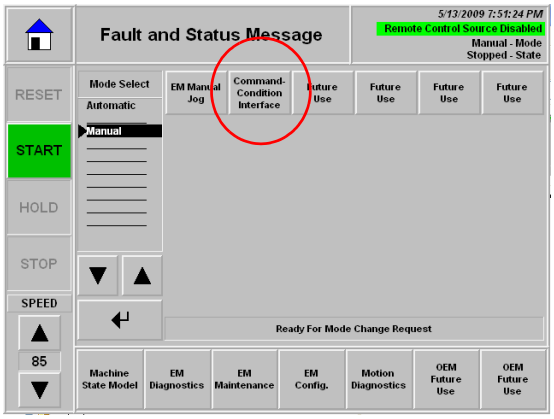
Fault Indicators	Faulted State	Non-Faulted State
Module Faults	Red	Grey
Drive Faults		

Use the Command Condition Display

Power Programming utilizes a Command/Condition interface between the unit and equipment modules.

Follow these steps to see the command or condition.

1. Navigate to the EM Maintenance display.
2. Press Command Condition Interface.



The Command Condition display opens.

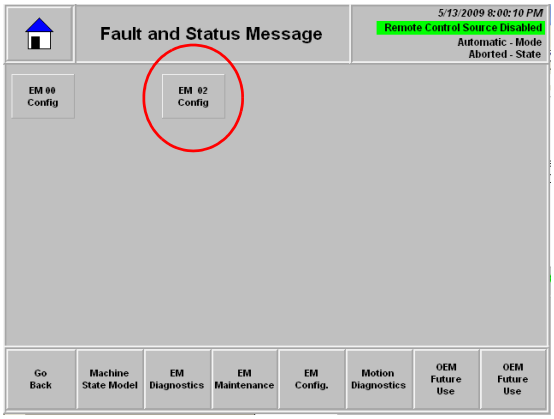
The picture here shows that the machine condition is faulted.

Use the EM Configuration Display

Normally each equipment module needs to be configured, for example, for max acceleration and speed. This is done on the EM configuration display for each individual EM.

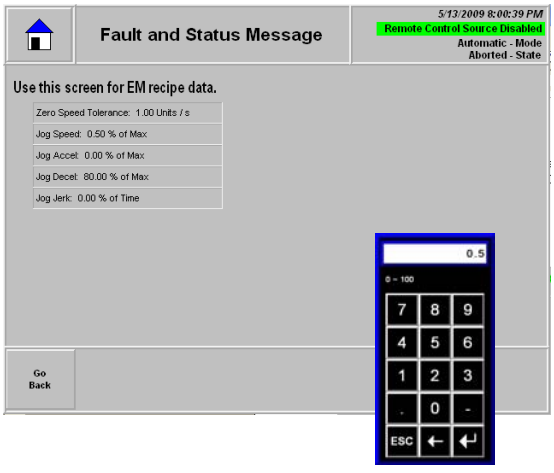
Follow these steps to use the EM Configuration Display.

1. Navigate to the EM Config display.



2. Press EM 02 Config.

The Configuration display for EM02 opens.

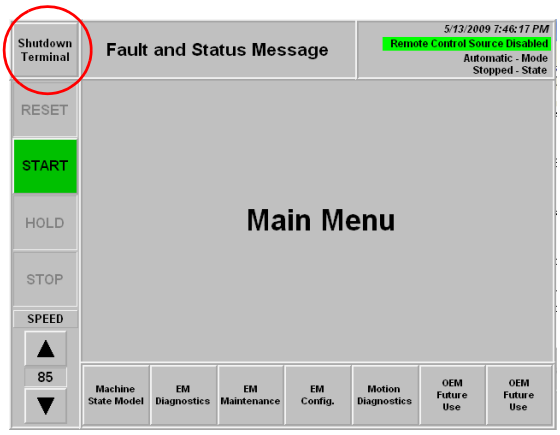


3. Change any of the settings that need to be changed by pressing on its associated text and then key the new value into the numeric input display.

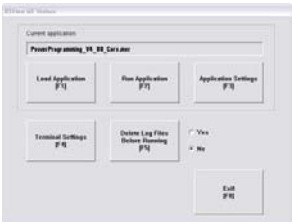
Shut Down Application

To shut down the application, follow these steps.

1. Navigate to the Main Menu using the Home button.
2. Press Shutdown Application.



The PanelView Plus terminal returns to the FactoryTalk View ME Station display.



Motion Analyzer Motion Profile Export

In this chapter, you create a PCam (Position Cam) profile by using Motion Analyzer software and exporting the PCam data to your Logix program. Motion Analyzer is a comprehensive motion-control software tool with application analysis used for sizing your application.

Motion Analyzer software, version 4.6 or later, creates a move profile while sizing your servo application and includes a Profile Editor that is capable of exporting Motion Moves and Complex Motion Move profiles to your RSLogix 5000 program.

This chapter does not cover the sizing of your motion application by using Motion Analyzer software, only the export of the profile to your RSLogix 5000 program. To download Motion Analyzer software, refer to Get Motion Analyzer Software on page 14.

Before You Begin

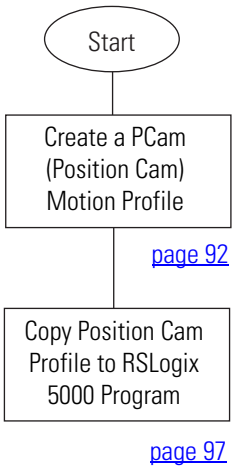
- Complete your system hardware selection. (Refer to Chapter 1.)
- Install Motion Analyzer software, version 4.6 or later, on your hard drive.
- Complete your Logix Integration procedures. (Refer to Chapter 4.)

What You Need

- Kinetix Accelerator Toolkit DVD, publication IASIMP-SP004. For a copy of the DVD, contact your local Rockwell Automation distributor or sales representative.
- Motion Analyzer software, version 4.6 or later.
- RSLogix 5000 software, version 17.0 or later.
- Logix application file PowerProgramming_CLX_V4_00_Core.acd.
  Logix files are available on the Kinetix Accelerator Toolkit DVD.

Follow These Steps

Complete the following steps to create a Motion Axis Move (MAM) instruction and export it to your RSLogix 5000 program.

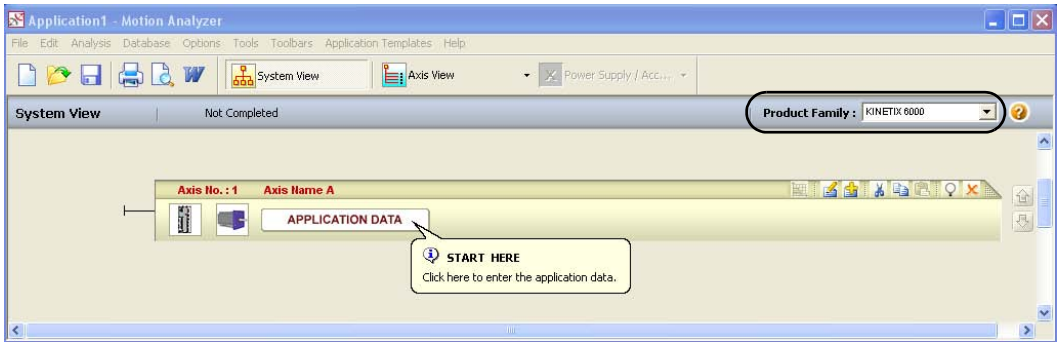


Create a PCam (Position Cam) Motion Profile

Follow these steps to create a motion profile example by using Motion Analyzer software.

1. Open your Motion Analyzer software.

   The System View dialog box opens.

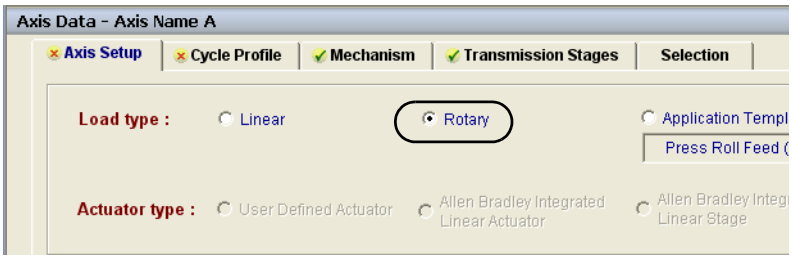


2. From the Product Family pull-down menu, choose your servo drive product family.

   Kinetix 6000 product family is used in this example.

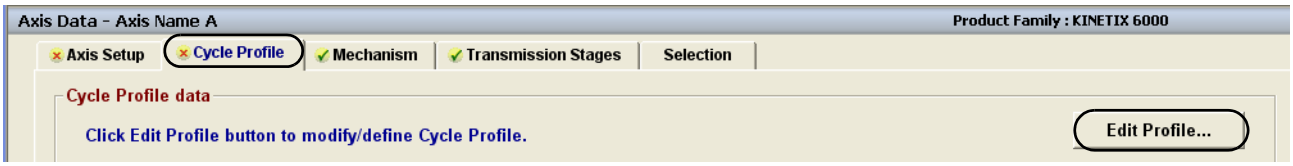
3. Click APPLICATION DATA.

The Axis Data dialog box opens.



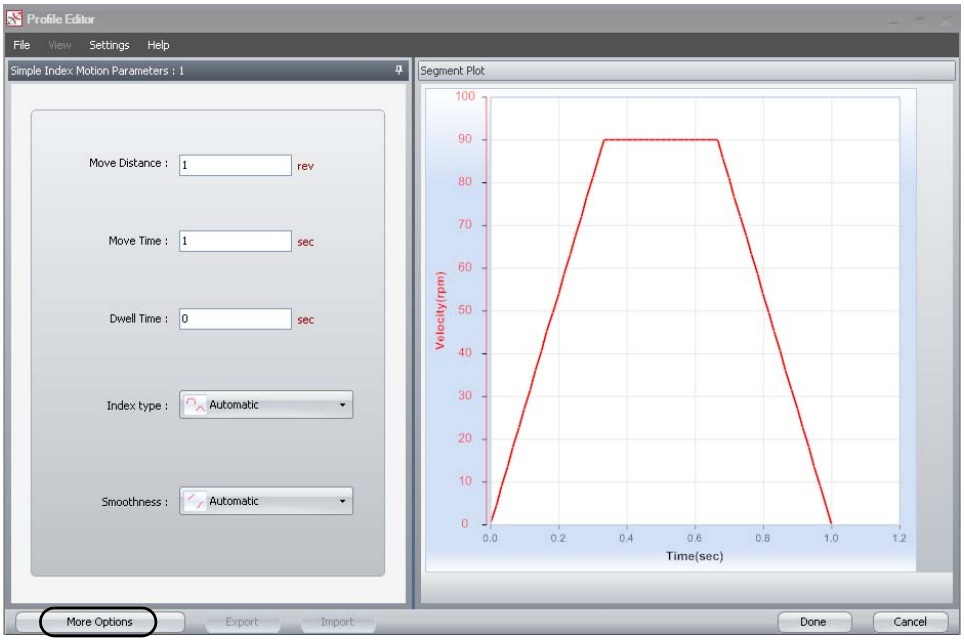
4. Click Rotary.

5. Click the Cycle Profile tab.



6. Click Edit Profile.

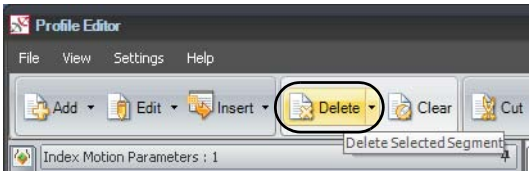
The Profile Editor window opens.



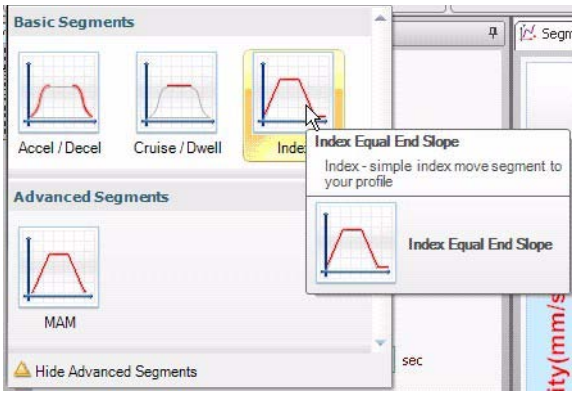
7. Click More Options.

The Profile Editor displays additional tools for editing your motion profile.

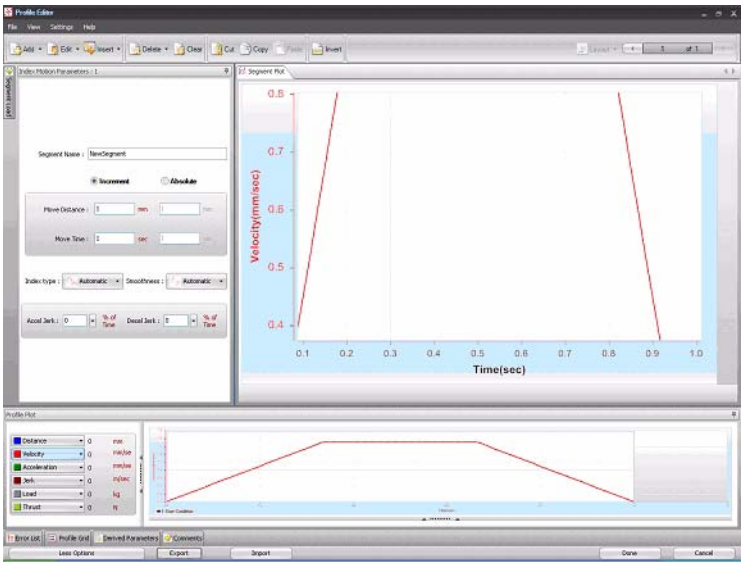
8. Click Delete to clear the default index move profile.



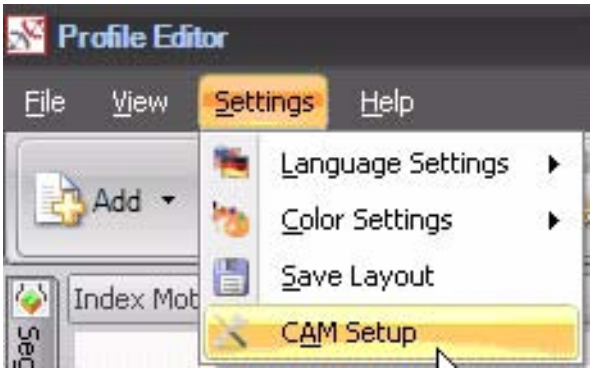
9. From the Add pull-down menu, choose Index.



The Index Profile parameters window appears.



10. From the Settings menu, choose CAM Setup to define Master and Slave Units.

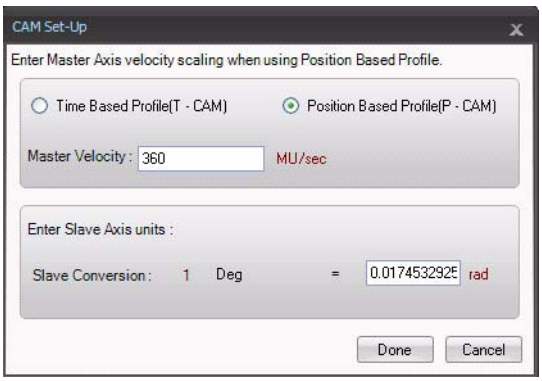


11. Type the master and slave units.

Select Position Based Profile(P-CAM).

Master Velocity: 360 MU/sec

Slave Conversion: 1 deg = 0.0174532925 rad



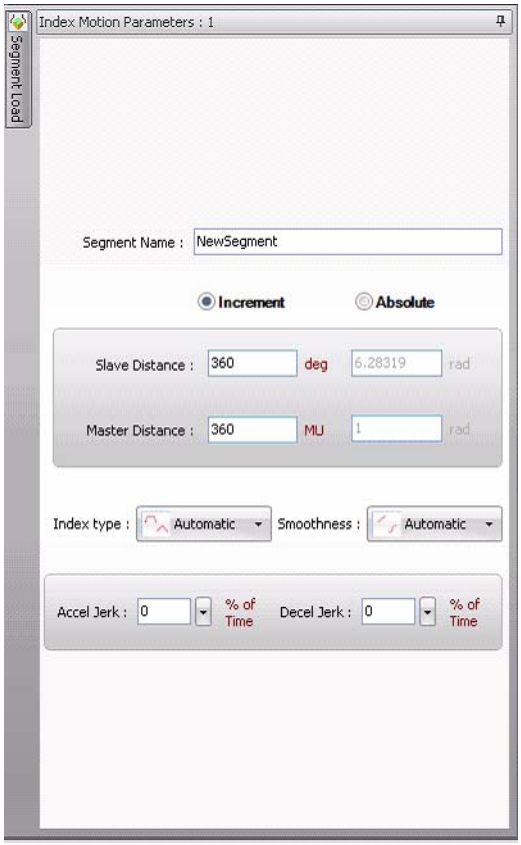
12. Click Done to return to the prior screen.

13. Type the following parameter data into the Index Parameter fields on the left side of the screen.

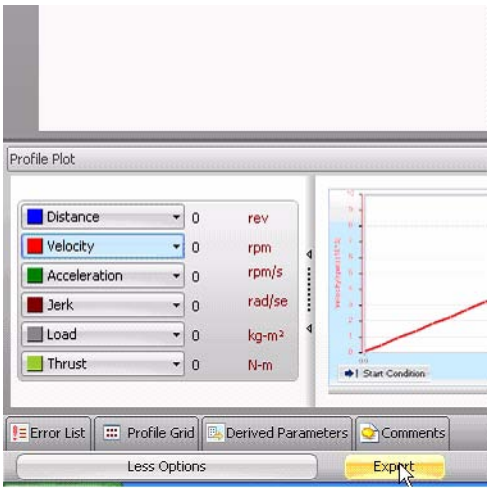
Slave Distance: 360 deg

Master Distance: 360 MU

Leave all other parameters at default values.



14. Click Export to export this profile to your RSLogix 5000 program.



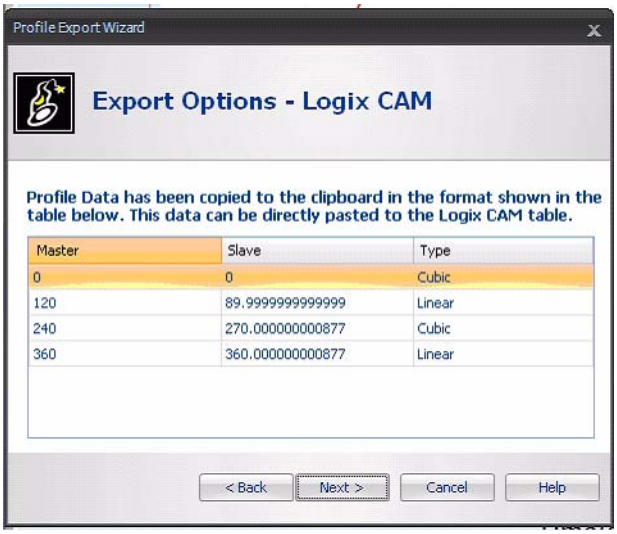
The Profile Export Wizard appears.

15. Click Next.

16. Click Logix CAM Profile Editor.

17. Click Next.

The Index profile is copied to the clipboard.



Copy Position Cam Profile to RSLogix 5000 Program

In this example, the preconfigured Logix file (PowerProgramming_CLX_V4_00_Core.ACD) is modified to replace the Position Cam (PCam) in the Equipment Module (Program) "EM02_PCamBasic" with the profile copied to the clipboard in the previous procedure.

Follow these steps to add the PCam Profile to your RSLogix 5000 program.

1. Open the PowerProgramming_CLX_V4_00_Core.ACD application file.

   The RSLogix 5000 software launches and your application file opens.

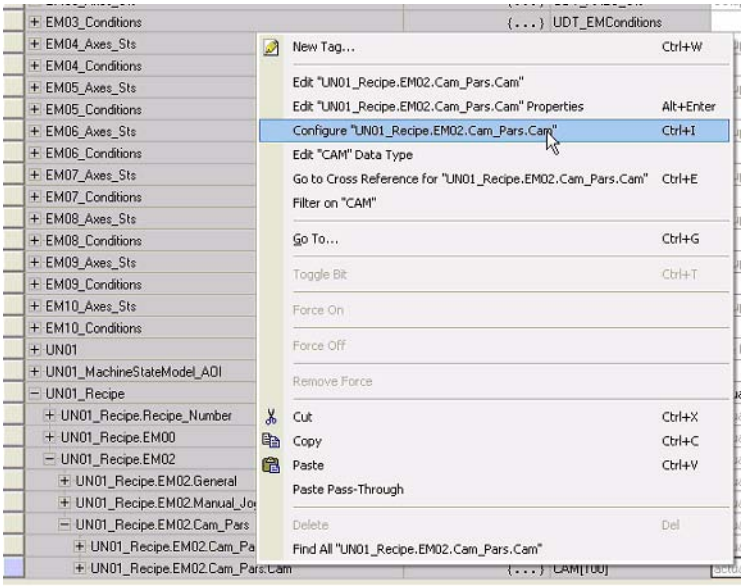
2. Expand the Controller Tags and double-click R06_MotionProgram.

3. Expand the tag UN01_Recipe.EM02.Cam_Pars.

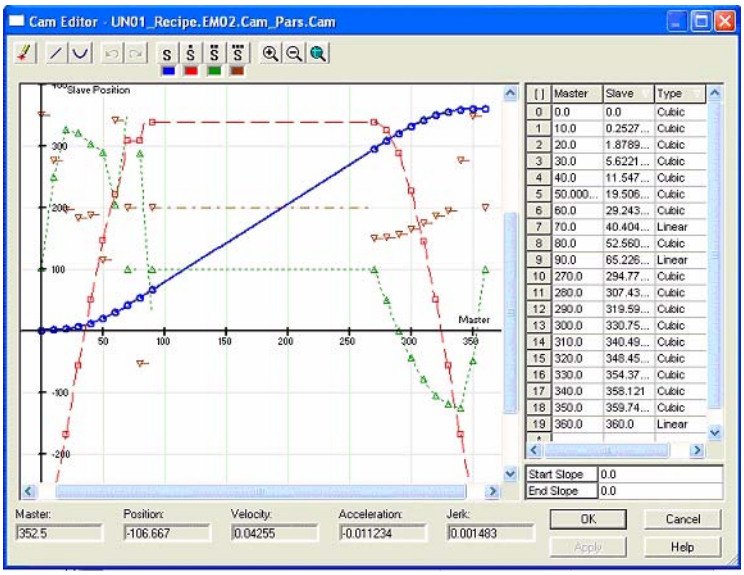
TIP The PCam Data for EM02_PCamBasic is stored in the UN01_Recipe structure and is accessible for modification and verification.

4. Enter the number of Cam Points of your Index Profile into UN01_Recipe.EM02.Cam_Pars.No_of_Cam_Points (set to 4 in the example shown above).

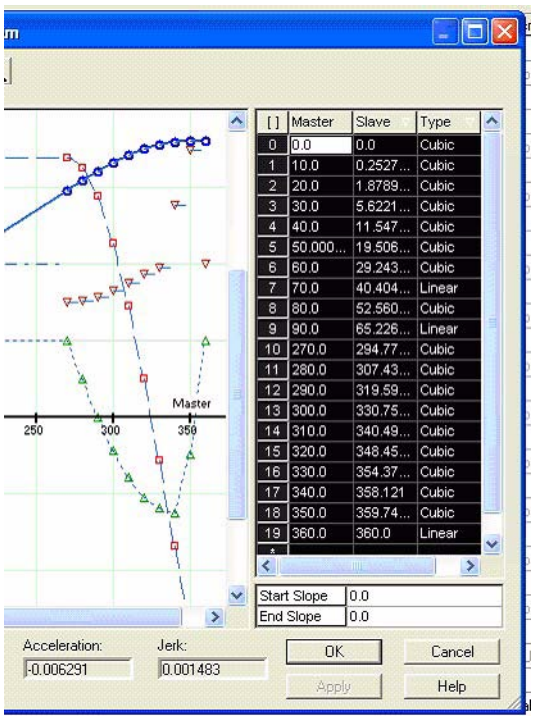
5. Right-click Un01_Recipe.EM02.Cam_Pars.Cam and select Configure "UN01_Recipe.EM02.Cam_Pars.Cam".



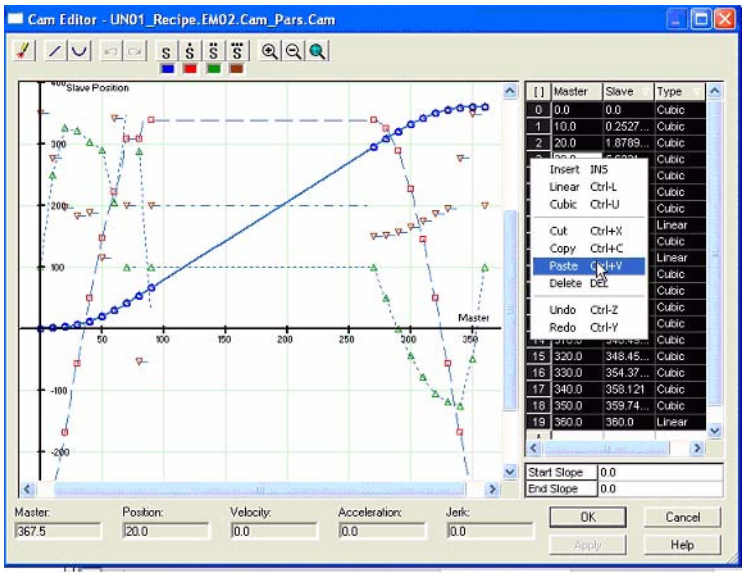
The Cam Editor dialog box opens.



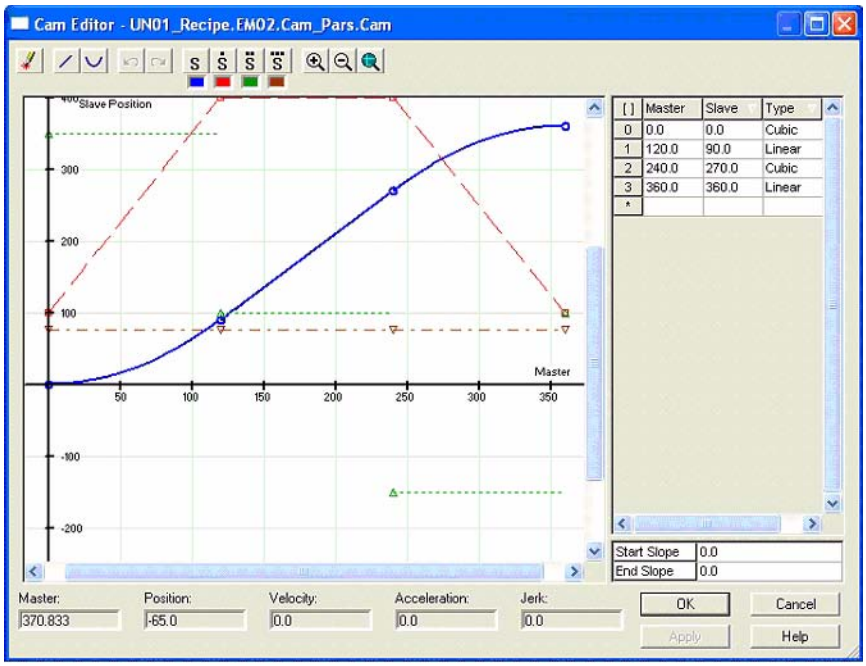
6. Mark all points in the Cam table.



7. Right-click the Cam Table and choose Paste.



8. Click Apply to accept the changes.



The PCam Profile has now been changed to your Index Profile from Motion Analyzer and is ready for execution.

When starting the application, the Equipment Module EM02_PcamBasic will use the newly-configured Cam from Motion Analyzer.

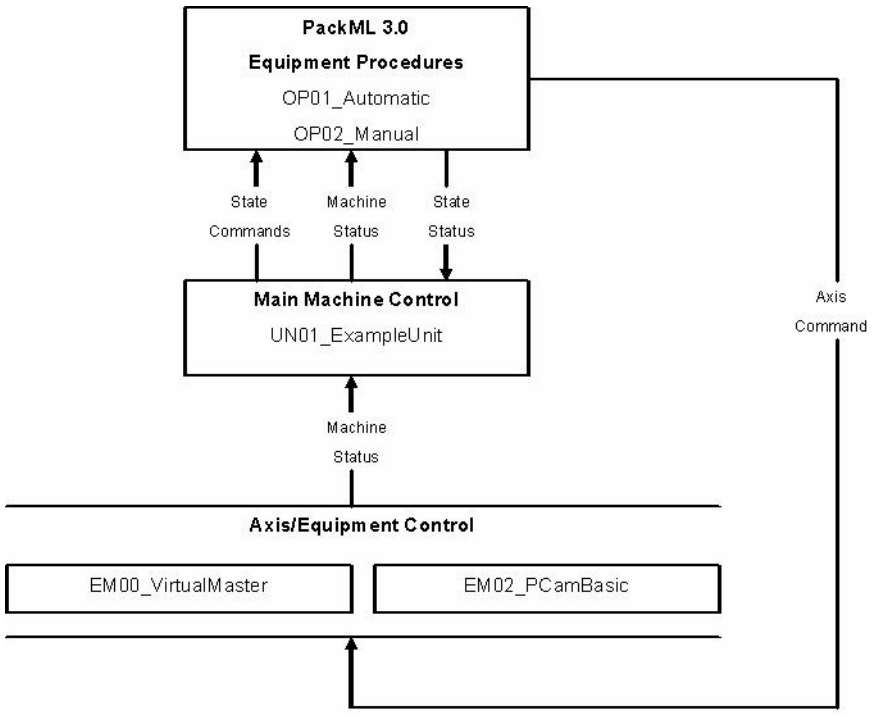
Logix Base Program Overview

The pre-configured Logix program is a Rockwell Automation solution that helps machine builders and end users streamline their motion control programming. This application template provides a basis for using motion control, understanding the principles of state programming, and creating a consistent program structure.

The Logix program template:

- incorporates ISA S88 programming methodology.
- integrates the PackML 3.0 state model into your controller logic.
- provides a base structure, making it easier to write, use, and manage the code for your machine or equipment.
- provides modularity in machine programming.
- provides integration of library modules.
- streamlines the development of application programs.

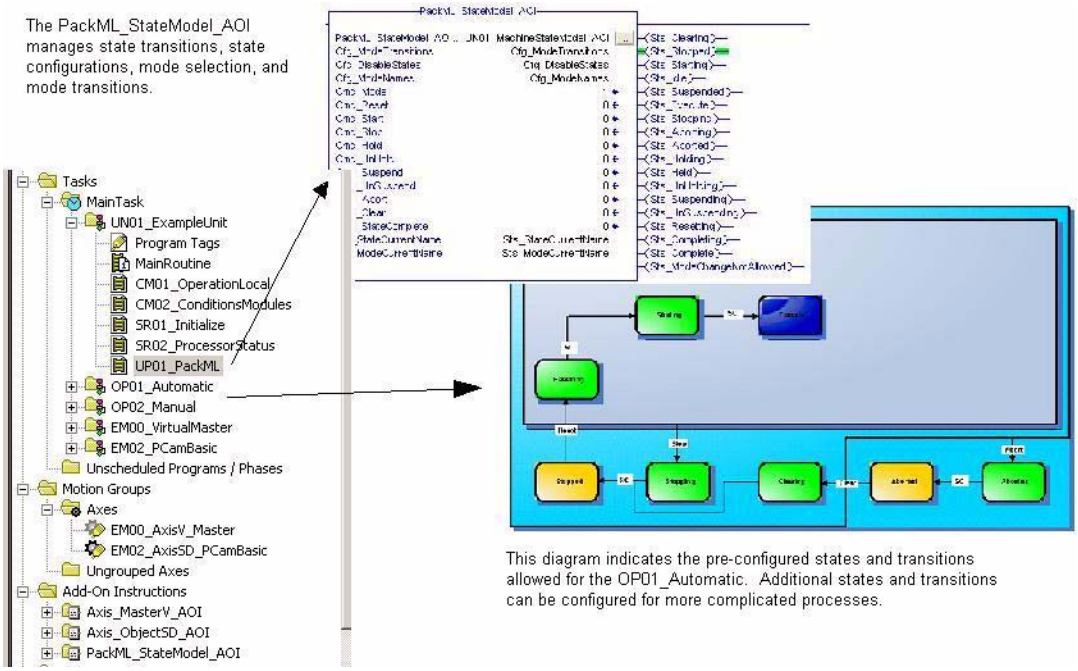
Basic Program Flow



PackML 3.0 State Model Integration

State model programming provides a way to execute processing procedures based on machine conditions, but independent of the direct equipment control logic. This is an essential component to modular programming. The PackML 3.0 state model, a recognized standard in the packaging segment, is implemented in this example using an Add-On Instruction (AOI) that manages from 1…32 modes, each having its associated instance of the state model. The states may be enabled and disabled as required depending on the needs of the mode.

PackML 3.0 State Model Tag and Logic Integration



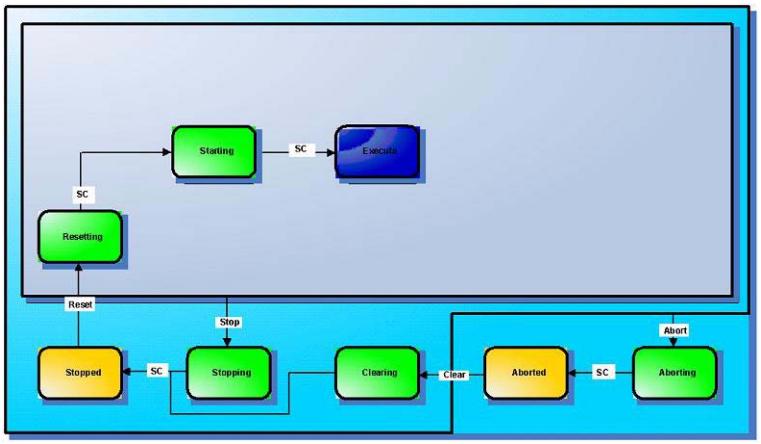
The Logix program template provides examples for two unit operations associated with the automatic and manual machine modes.

- OP01_Automatic - Controls the machine when in automatic mode
- OP02_Manual - Controls the machine when in manual mode

An operation is implemented as a program that runs in a task and has a set of routines and tags. An operation uses a state model to execute the processing procedure for operating modes, such as automatic or manual.

A state model divides the operating cycle of your equipment into a series of states. Each state is an instant, or snapshot in time, in the operation of the equipment and indicates a defined set of machine conditions that are currently set. You define the processing activities that the equipment executes during each state in response to requests, such as clear, start, and stop. You don't need to use all the states for your equipment. Use only the states that you need.

PhaseManager State Model



- Your equipment can go from any state in the box to the stopping or aborting state.
- Acting states (**green** - Starting, Resetting, Stopping, Clearing, Aborting) represent the things your equipment does at a given time.
- Waiting states (**gold** - Stopped, Aborted) represent the condition of your equipment when it is in between acting states.

With a state model, you define the behavior of your equipment and put it into a brief functional specification. In this way you show what happens and when it happens. In this example, OP01_Automatic uses the following states.

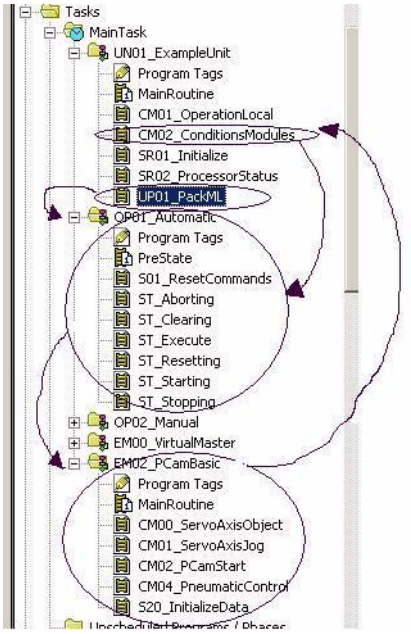
State Model Behavior

For this state	Ask
Stopped	What happens when I turn on power?
Resetting	How does the equipment get ready to run?
Starting	What does the equipment do to start making product?
Execute	What does the equipment do to make the product?
Clearing	How does the equipment reset faults or failures?
Stopping	What happens during a normal shutdown?
Aborting	How does the equipment shut down if a fault or failure happens?
Aborted	How can I tell if the equipment is safely shut down?

Main Machine Control (UN01_ExampleUnit)

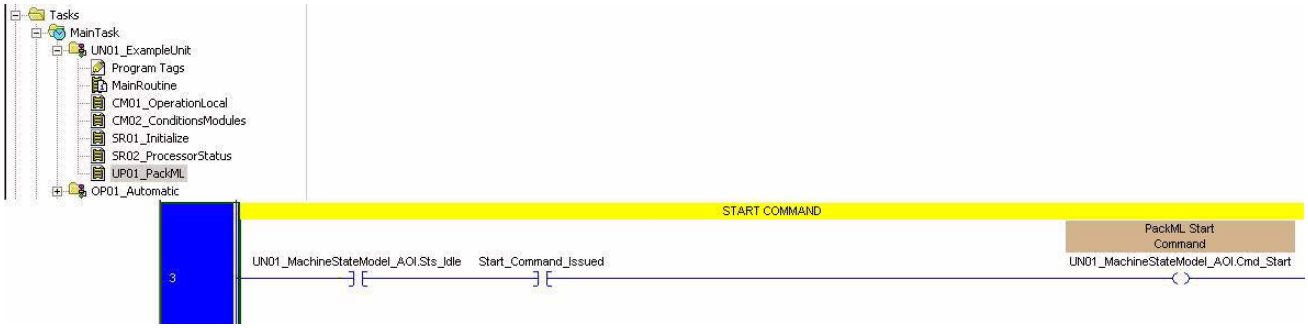
The unit control, UN01_ExampleUnit program within the Main Task, provides a single point for machine conditions and operator requests, and all machine control is initiated there. The transitions of operating modes and operation states are controlled in this program using the PackML_StateModel_AOI explained above. The transitions are done based on user input from the HMI and machine conditions.

Main Machine Control Flow



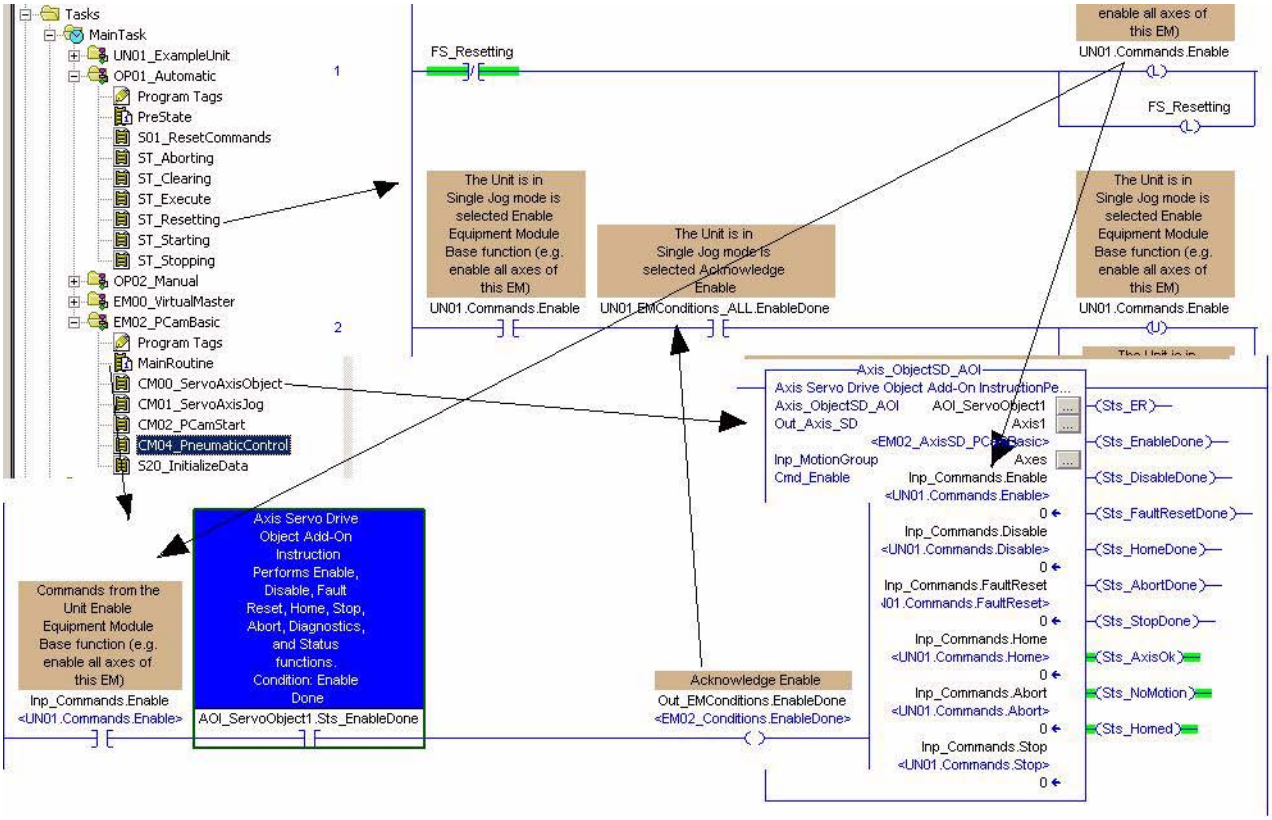
In the UN01_ExampleUnit rung example below, if the conditions (auto idle state and user start command) are met, a start state transition command is initiated.

Start Phase Command Rung



Axis/Equipment Control

The axis control is consolidated in the EM*xx* programs. The individual axis equipment actions are requested based on the unit operation state. Structures for operating commands and conditions have been defined as a common interface to provide easy integration of additional equipment modules. These structures may be altered or amended to fit your application needs in order to provide independent control or additional functionality of equipment. In the rungs of code below, within the Execute state logic for OP01_Automatic, a member of the commands structure (Inp.Commands.PrepareExecution) is set to initiate position cam synchronization of the physical axis to the virtual master axis.

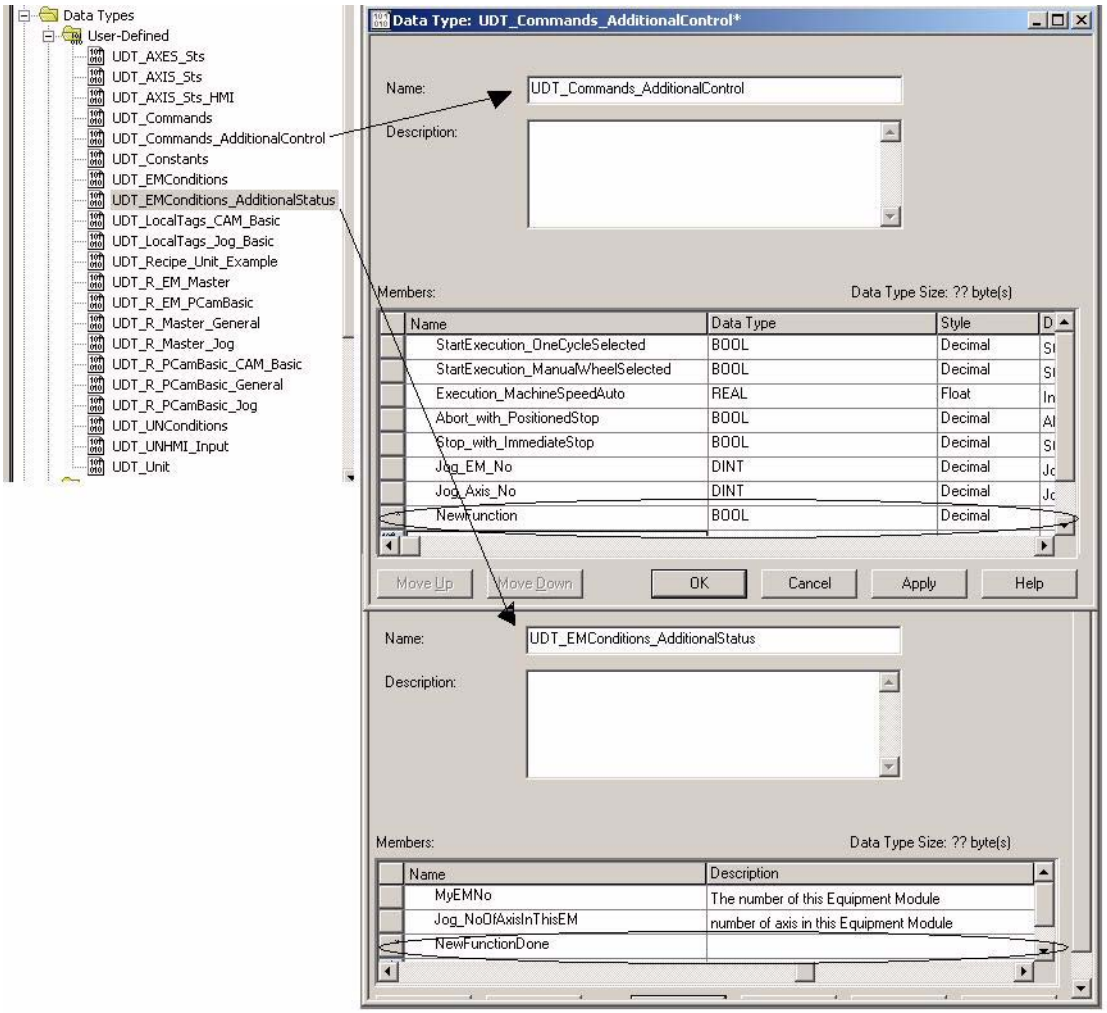


Add Your Application Code

Application code may be added by altering or replacing the current routines, or by adding new routines. Follow these steps to add application code to each of your EM*xx*_SectionName programs.

1. In RSLogix 5000 software, expand the Explorer window to gain access to Tasks and Data Types.

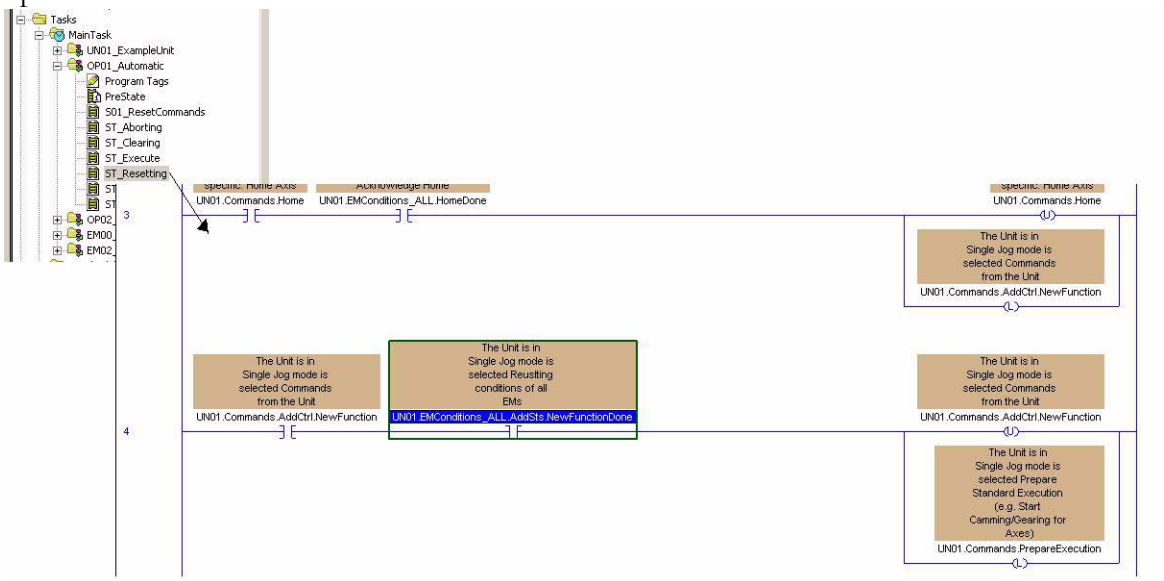
2. Modify the UDTs UDT_Commands_AdditionalControl and UDT_EMConditions_AdditionalStatus by adding the BOOL elements for the function to supply a command and a done status.



3. Click OK.

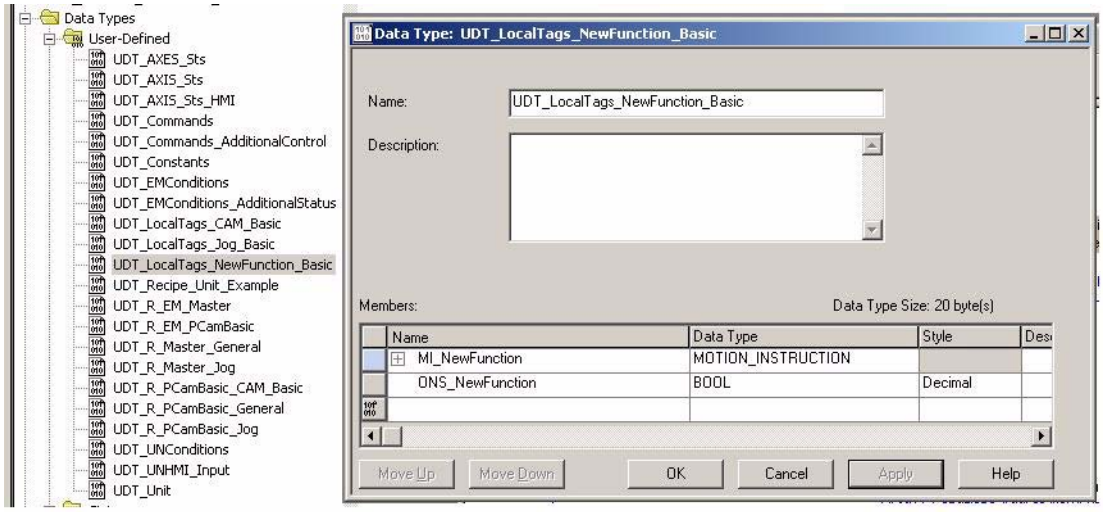
4. Expand Tasks, MainTask, OP01_Automatic.

5. Edit the proper state routine to add the function.

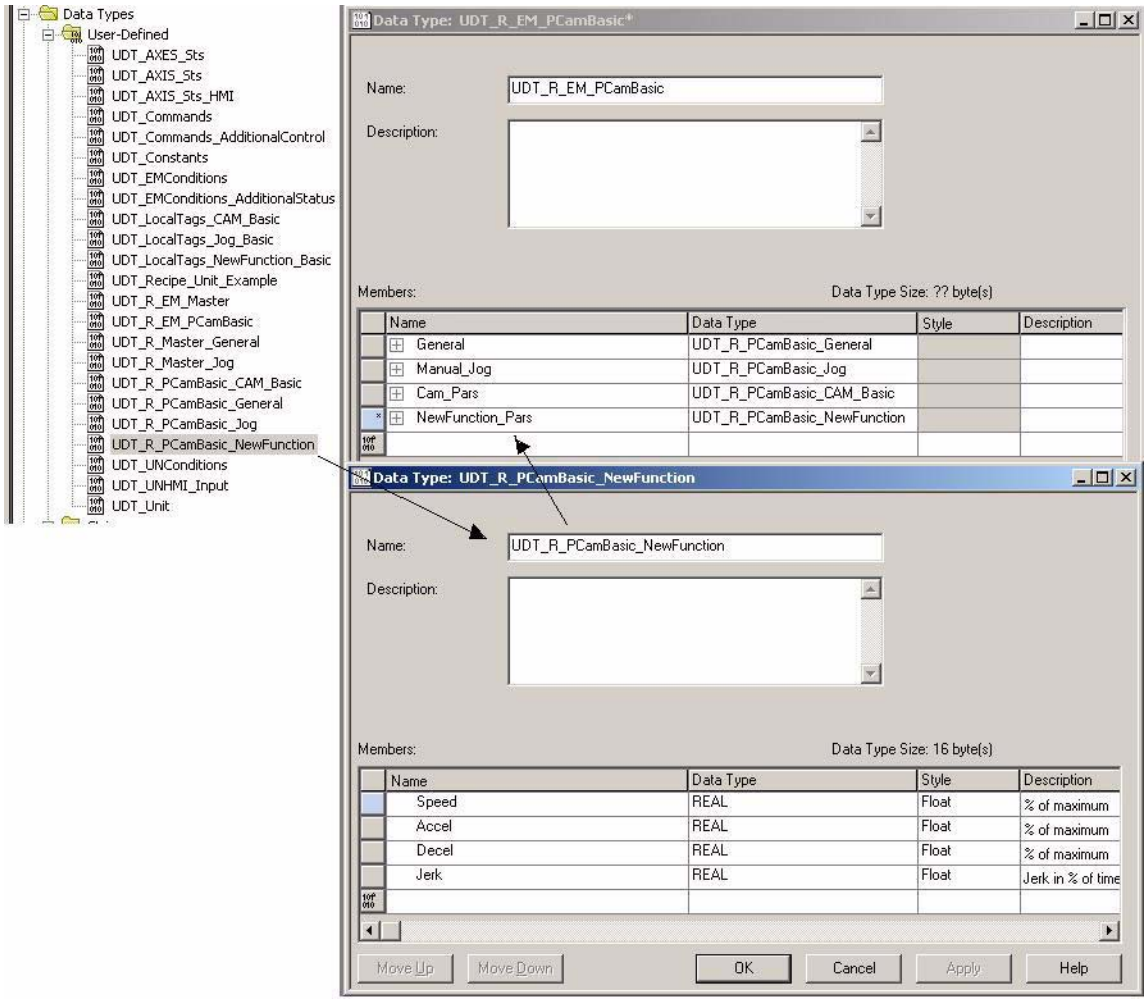


6. Expand Tasks, MainTask, EM02_PCamBasic and edit the MainRoutine to add the EM condition status and a JSR for the new CM function.

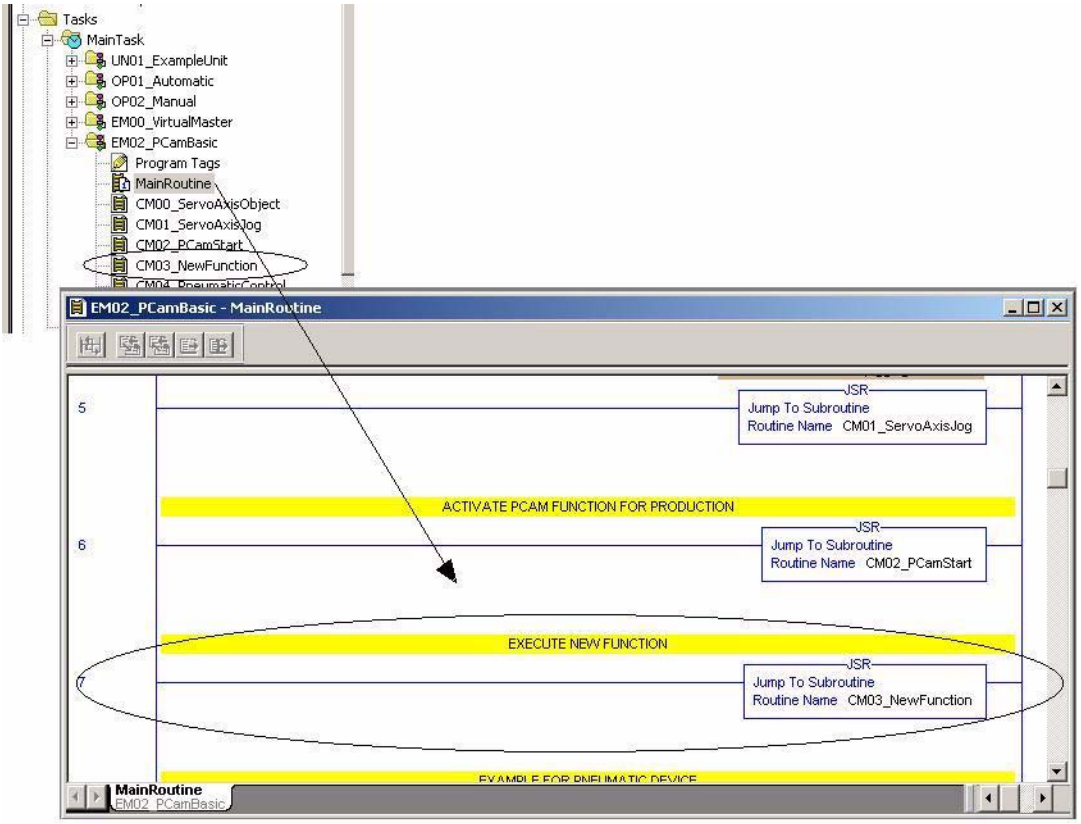
7. Add a new data type called UDT_LocalTags_*xxxx*_Basic which is used for elements such as motion instruction control tags, one-shot tags, and other tags required to execute the function.



8. Add a new data type called UDT_R_PCamBasic_*xxxx* which contains elements for any parameter information required for the function. Add an element to UDT_R_EM_PCamBasic for this new function.



9. Add a new CM routine to EM02_PCamBasic with the logic to execute the new function. Use the command Inp_Commands.AddCtrl.*xxxx* to initiate the logic.

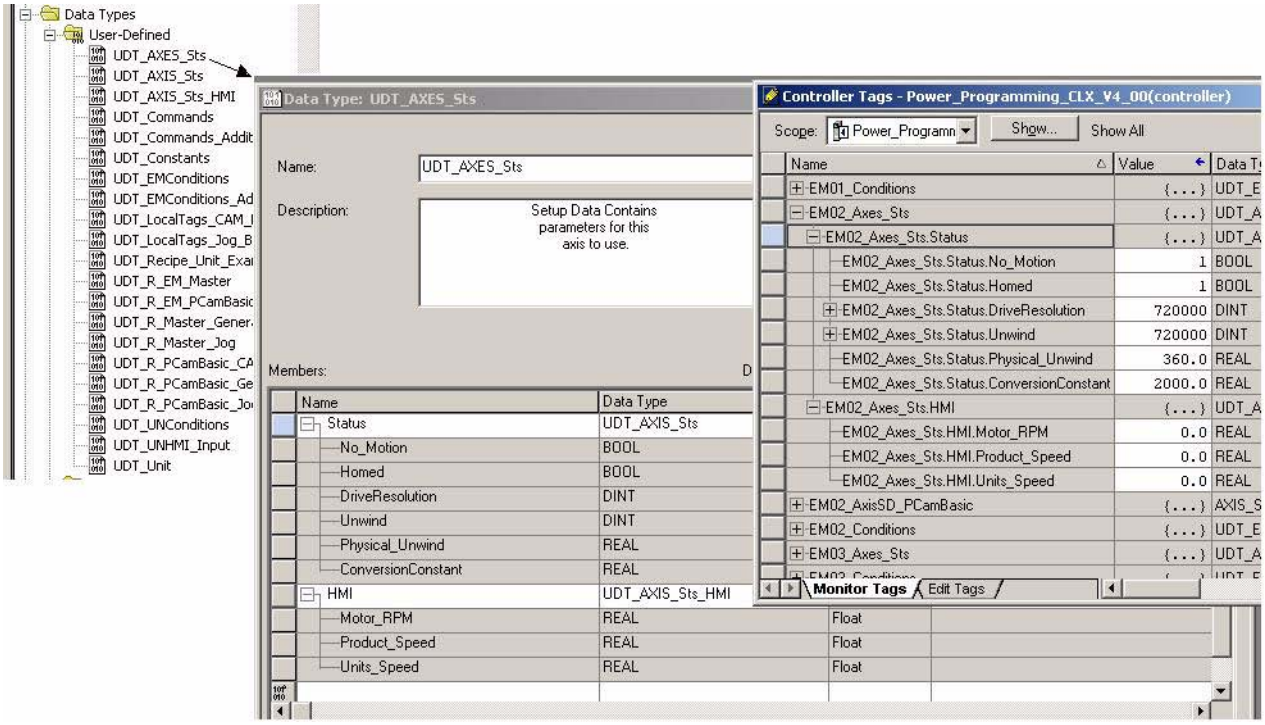


User-defined Data Types (UDTs)

The pre-configured Logix program uses pre-configured user-defined data types (UDT). These are structures that organize data, status information, and commands for machine process and equipment.

For example, this pre-configured UDT stores all the data for an axis, including speeds, accelerations, decelerations, direction, and sequencers. A tag structure is created for each axis based on this data type.

Axis Data UDT Example



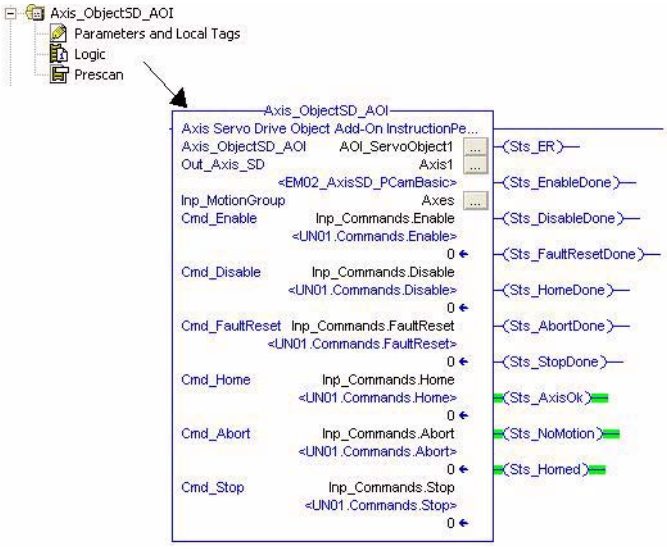
A UDT provides these advantages:

- One tag contains all of the data related to a specific aspect of your system. This keeps related data together and easy to locate, regardless of its data type.
- Each individual piece of data (member) gets a descriptive name. This automatically creates an initial level of documentation for your logic.
- You can use the data type to create multiple tags with the same data layout.

Add-On Instructions (AOIs)

The pre-configured Logix project uses pre-configured add-on instructions (AOI). These are objects that allow the programmer to associate logic and data in a common construct that may be reused throughout the project.

For example, this pre-configured AOI executes the basic state control of a servo axis, including fault reset, enable, disable, and pre-configured home. This instruction may be reused for every axis in the application, and the homing may be disabled in favor of more complex home sequences.



An AOI provides these advantages:

- Repetitive logic may be entered once and reused multiple times throughout the project.
- Alterations to the logic are immediately applied to all instances in the project.
- Security may be applied to restrict access to the logic and tag definition.

General

The template makes use of these add-on instructions (AOI):

- Axis_MasterV_AOI (page 113)
- Axis_ObjectSD_AOI (page 120)
- PackML_StateModel_AOI (page 127)

The prefixes below are common to all the AOIs. Tags for the AOI have the following meanings.

- **Out_**

  Real-time output data driven from the AOI process. Generally used to designate a connection to a real output point, a control device, or to data sent to other calculation processes.

- **Cfg_**

  Generally used to designate a value used in configuring how the process within the AOI functions. This is only occasionally changed. It can be entered from the HMI or as part of a recipe.

- **Cmd_**

  Generally used to as a command input, either from the operator via the HMI or from the program.

- **Par_**

  Parameters are variables that are received from an external source, such as a batch or a recipe management system that can be internal or external to the program.

- **Sts_**

  Status of the process within the AOI instruction.

- **Err_**

  If the Sts_Er bit is on, the Err_ parameter will indicate which actual error is occurring within the process. This can be either a bit-level or value-level indication. Value-based annunciating of the error allows for a large quantity of errors to be supported within a single indicator. However, this approach requires that errors be annunciated one at a time. Bit-level erroring can support multiple errors simultaneously, but can require a large number of indicators to support all error states.

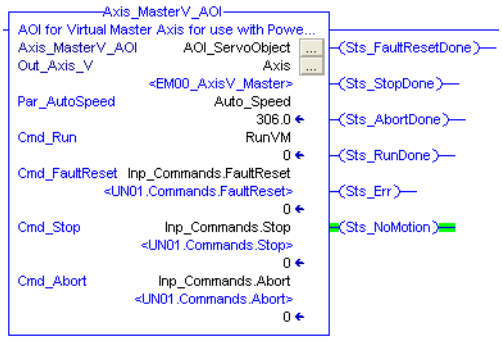
- **Inp_**

  Real-time input data used to drive the process of an AOI. Generally used to designate a connection either to a real input point, a control device, or to data received from other calculation processes.

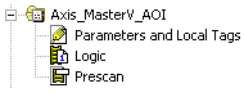
Axis_MasterV_AOI

Overview

The Axis_MasterV Add-On Instruction will perform Reset, Jog, and StopAtPosition and will show the status of a virtual master axis.



The AOI consists of Parameters and Local Tags, and a routine for Logic and Prescan.



These configuration tags need to be configured for the AOI to work correctly:

- Cfg_AbortWithPositionedStop - See Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone on page 117.
- Cfg_StopWithImmediateStop - See Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone on page 117.
- Cfg_ZeroSpeedTolerance - See Sts_NoMotion on page 119.

Parameters and Local Tags

Only a few of the tags in the table below are visible on the AOI itself, and most of the other tags can be referenced via the backing tag outside the AOI. Local Tags can only be referenced inside the AOI, and are not discussed here.

Below is a table with all tags that can be referenced outside the AOI.

Name	Usage	Type	Description
Out_Axis_V	InOut	AXIS_VIRTUAL	Axis to control
Cfg_AbortWithPositionedStop	Input	BOOL	0: Cmd_Abort will make an immediate stop 1: Cmd_Abort will make a positioned stop
Cfg_StopWithImmediateStop	Input	BOOL	0: Cmd_Stop have other dependencies 1: Cmd_Stop will make an immediate stop
Cfg_ZeroSpeedTolerance	Input	REAL	Axis is considered stopped if below this value
Cmd_Abort	Input	BOOL	Command to abort
Cmd_FaultReset	Input	BOOL	Command to reset faults
Cmd_Run	Input	BOOL	Command to run
Cmd_Stop	Input	BOOL	Command to stop
EnableIn	Input	BOOL	Enable Input (System-defined parameter)
Par_AutoAbortDecel	Input	REAL	Deceleration value for immediate stop
Par_AutoAccel	Input	REAL	Acceleration value for normal conditions
Par_AutoDecel	Input	REAL	Deceleration value for normal conditions
Par_AutoSpeed	Input	REAL	Speed value for normal conditions
Par_Position_ForPositonedStop	Input	REAL	Position value for “positioned stop”
EnableOut	Output	BOOL	Enable Output (System-defined parameter)
ERR_InstructionFault	Output	BOOL	Used if any of the motion instructions fault
Sts_AbortDone	Output	BOOL	Abort is successfully executed
Sts_Err	Output	BOOL	Used if the axis faults or if any of the motion instructions fault
Sts_StopDone	Output	BOOL	Stop is successfully executed

Prescan

The Prescan routine executes after the primary Logic routine executes in Prescan mode. It will initialize tag values to a known or predefined state prior to execution of the AOI.

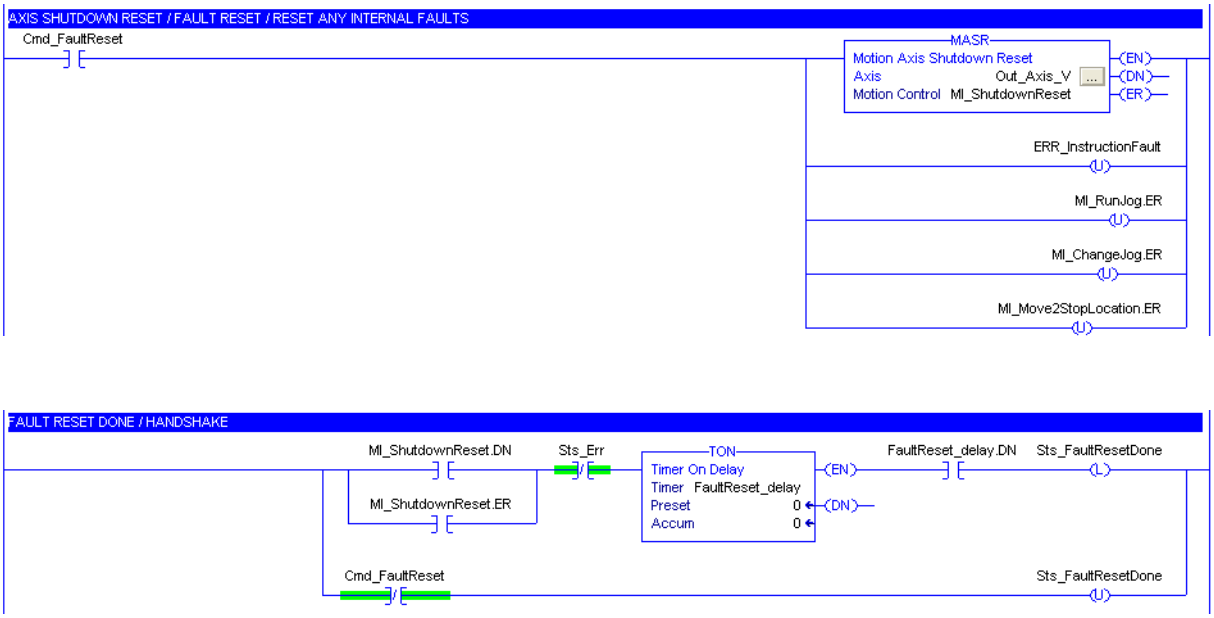
When an add-on instruction executes in Prescan mode, any required parameters have their data passed.

- Values are passed to Input parameters from their arguments in the instruction call.
- Values are passed from Output parameters to their arguments defined in the instruction call.

These values are passed even when the rung condition is false.

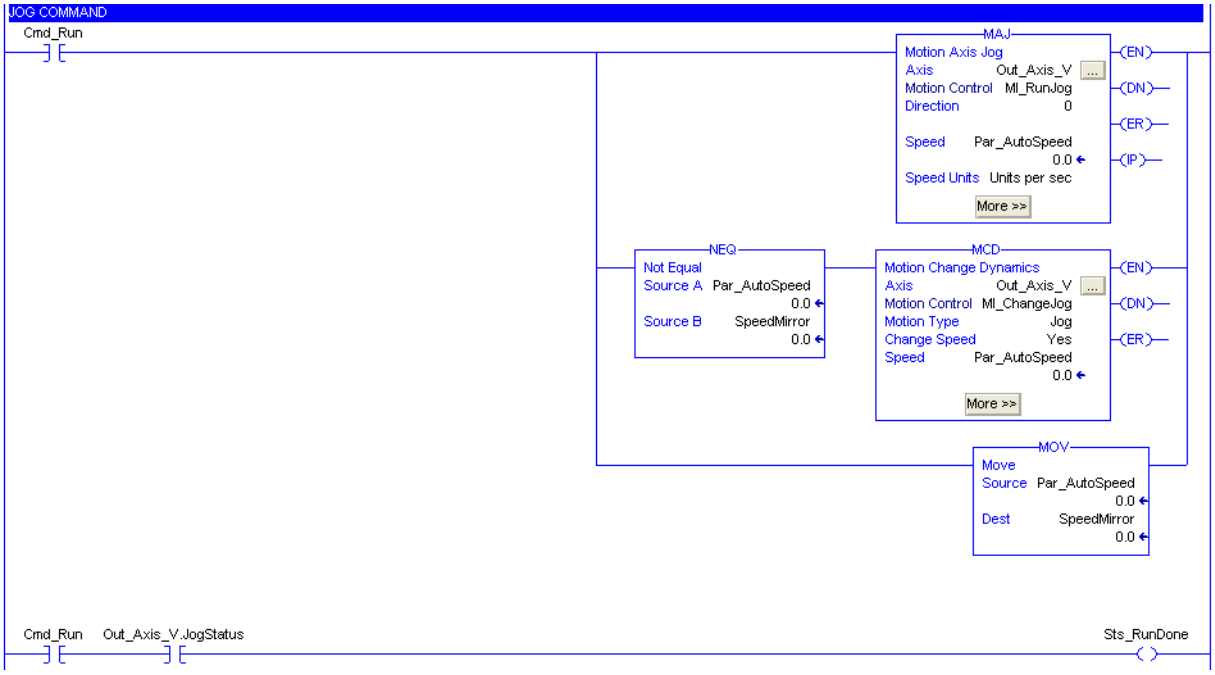
Cmd_FaultReset and Sts_FaultResetDone

When the command Cmd_FaultReset is set, all Err-bits of the AOI are unlatched and the axis will be reset with a MASR instruction (Axis Shutdown Reset). When Cmd_FaultReset is successfully executed, the Sts_FaultResetDone bit will be set.



Cmd_Run and Sts_RunDone

When Cmd_Run is set, the axis will start to jog at the predefined speed given by the tag Par_AutoSpeed. Speed can be changed at any time. When Cmd_Run is successfully executed, the Sts_ RunDone bit will be set.



Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone

The axis can be stopped in two ways – either immediately or at a defined position.

Stop immediately

The axis will stop immediately if

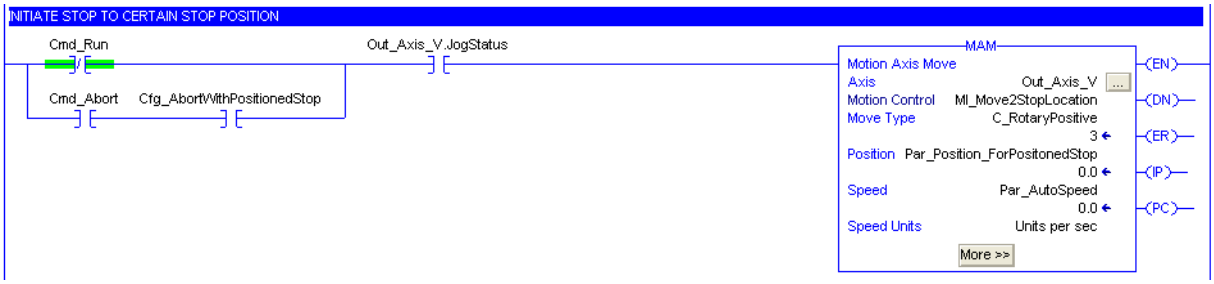
- Cmd_Abort is set and the use of the command is configured.
- Cmd_Stop is set and there is no motion on the axis.
- Cmd_Stop is set and the axis is configured to do an immediate stop.
- Cmd_Stop or Cmd_Abort is set and the "Stop at defined position" instruction faults.

Cfg_StopWithImmediateStop	Behavior
0	The axis does not execute the command.
1	The axis executes the command.

Stop at defined position

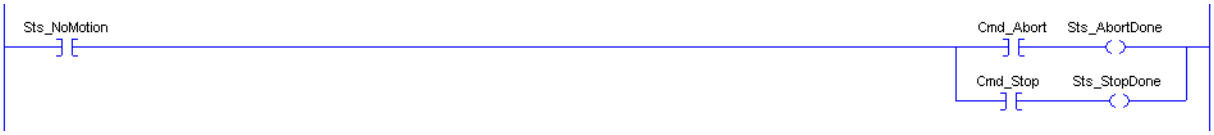
If the axis is jogging and Cmd_Run transitions to false or if Cmd_Abort is set, the axis will stop at a defined position, the latter only if configured to do so.

Cfg_AbortWithPositionedStop	Behavior
0	The axis does not execute the command
1	The axis executes the command



Sts_AbortDone and Sts_StopDone:

When Sts_NoMotion of the axis is detected and either a Cmd_Abort or Cmd_Stop command is set, either the Sts_AbortDone or Sts_StopDone status bit, as appropriate, is set.



Err_InstructionFault

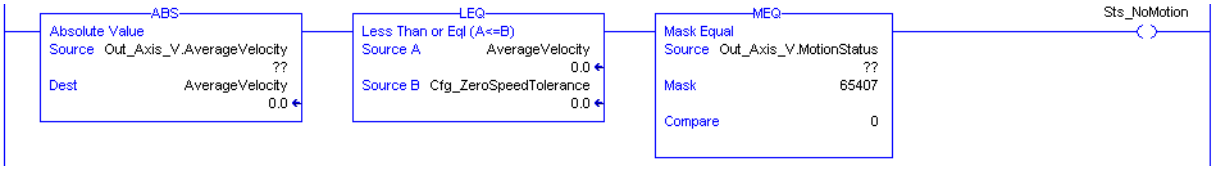
If any of the motion instructions fault, the ERR_InstructionFault bit is set.

Sts_Err

If the axis faults or if any of the motion instructions fault (ERR_InstructionFault), the Sts_Err bit is set.

Sts_NoMotion

"No motion" is when none of the motion planner inputs (such as gears, jogs, or CAMs) are active and the axis speed is less than the level configured in Cfg_ZeroSpeedTolerance.



The motion planner inputs are masked with the MotionStatus (Motion planner input) set this way:

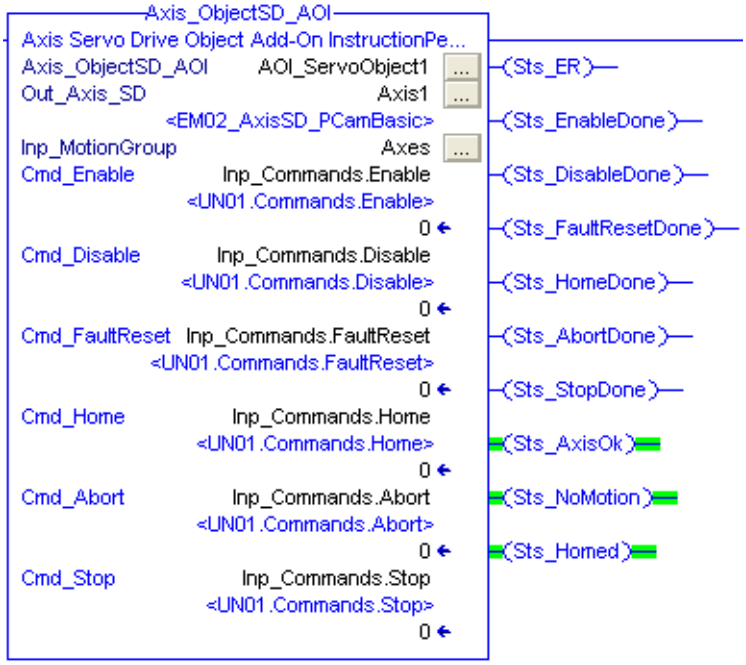
65407 [dec] = 1111 1111 0111 1111 [bin]

Bit	Description
00	AccelStatus
01	DecelStatus
02	MoveStatus
03	JogStatus
04	GearingStatus
05	HomingStatus
06	StoppingStatus
07	AxisHomedStatus
08	PositionCamStatus
09	TimeCamStatus
10	PositionCamPendingStatus
11	TimeCamPendingStatus
12	GearingLockStatus
13	PositionCamLockStatus
14	MasterOffsetMoveStatus
15	CoordinatedMotionStatus

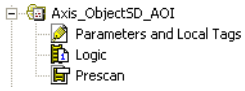
Axis_ObjectSD_AOI

Overview

The Axis Servo Drive Object Add-On Instruction performs Enable, Disable, Fault Reset, Home, Stop, Abort, Diagnostics, and Status functions of a physical axis.



The AOI consists of Parameters and Local Tags, and a routine for Logic and Prescan.



These configuration tags need to be configured for the AOI to work correctly:

- Cfg_UseVirtualMaster – See Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone on page 125.
- Cfg_StopEnabled – See Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone on page 125.
- Cfg_HomeEnabled – See Cmd_Home, Sts_Homed and Sts_HomedDone on page 124.
- Cfg_AbortEnabled – See Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone on page 125.

Note: When using RSLogix5000 V16, the value of these tags with a Cfg_ prefix may be reset to 0. This may affect expected execution. To avoid this, write logic into the S20_InitializeData routine of the program for any Equipment Module (EM) that uses this AOI to control the axis state to set the values of these tags. This routine is only executed on download, power-up, or cycling the processor to Run mode.

Parameters and Local Tags

Only a few of the tags in the table below are visible on the AOI itself, and most of the other tags can be referenced via the backing tag outside the AOI. Local Tags can only be referenced inside the AOI, and are not discussed here.

Below is a table with all tags that can be referenced outside the AOI.

Name	Usage	Type	Description
Cfg_AbortEnabled	Input	BOOL	Configuration: 1: CMD_Abort will execute MAS instruction 0: No stop instruction executed
Cfg_AbortRamp	Input	REAL	Ramp for MAS instruction in aborting
Cfg_HMIFPDisplay	Input	DINT	Internal tag used by the fault handling on the HMI
Cfg_HomeEnabled	Input	BOOL	Configuration: = 1: CMD_Home will execute MAH instruction = 0: No home instruction executed
Cfg_StopEnabled	Input	BOOL	Configuration: = 1: CMD_Stop will execute MAS instruction = 0: No stop instruction executed
Cfg_StopRamp	Input	REAL	Ramp for MAS instruction in stopping
Cfg_UseVirtualMaster	Input	BOOL	Configuration: = 1: Virtual master is used. Will wait for Inp_MasterNoMotion before executing MAS = 0: Will not wait
Cfg_ZeroSpeedTolerance	Input	REAL	Zero Speed Tolerance Window in units/sec for Sts_NoMotion
Cmd_Abort	Input	BOOL	Stops the Axis with AbortRamp Waits for Inp_MasterNoMotion if CfgUseVirtualMaster = 1
Cmd_Disable	Input	BOOL	Disables the Axis
Cmd_Enable	Input	BOOL	Enables the Axis
Cmd_FaultReset	Input	BOOL	Fault Reset
Cmd_Home	Input	BOOL	Home the Axis, if Cfg_HomeEnabled = 1
Cmd_Stop	Input	BOOL	Stops the Axis if Cfg_StopEnabled=1
EnableIn	Input	BOOL	Enable Input (System-defined parameter)
EnableOut	Output	BOOL	Enable Output (System-defined parameter)
Err_FeedbackFault	Output	BOOL	Any Feedback Fault including Aux Feedback
Err_General	Output	BOOL	Any General Fault

Err_GuardFault	Output	BOOL	Any Guard Fault (Safety Fault)
Err_InstructionFault	Output	BOOL	Any instruction within the AOI faulted
Err_MAHFault	Output	BOOL	MAH instruction Fault
Err_MSOFault	Output	BOOL	MSO instruction Fault
Err_NegOvertravel	Output	BOOL	Any negative Overtravel Fault
Err_OverloadFault	Output	BOOL	Any Overload/Voltage Fault
Err_PositionError	Output	BOOL	Position Error window exceeded
Err_PosOvertravel	Output	BOOL	Any positive Overtravel Fault
Err_TemperatureFault	Output	BOOL	Any Temperature Fault
Inp_MasterNoMotion	Input	BOOL	Indicates no motion of master (when master is at standstill)
Inp_MotionGroup	InOut	MOTION_GROUP	Status of motion group
Out_Axis_SD	InOut	AXIS_SERVO_DRIVE	Axis to control
Sts_AbortDone	Output	BOOL	Condition: Aborting Done
Sts_AbsoluteReferenceStatus	Output	BOOL	Absolute Feedback device shows Reference Ok
Sts_AxisOk	Output	BOOL	Status Display: Axis ready to enable
Sts_DisableDone	Output	BOOL	Condition: Disable Done
Sts_EnableDone	Output	BOOL	Condition: Enable Done
Sts_ER	Output	BOOL	Any fault occurred on this Axis
Sts_FaultResetDone	Output	BOOL	Condition: Fault Reset Done
Sts_Homed	Output	BOOL	The Axis has been homed
Sts_HomeDone	Output	BOOL	Condition: Home Done
Sts_NoMotion	Output	BOOL	AverageVelocity within ZeroSpeedTolerance and no MotionStatus set
Sts_StopDone	Output	BOOL	Condition: Stopping Done

Prescan

The Prescan routine executes after the primary Logic routine executes in Prescan mode. It will initialize tag values to a known or predefined state prior to execution of the AOI.

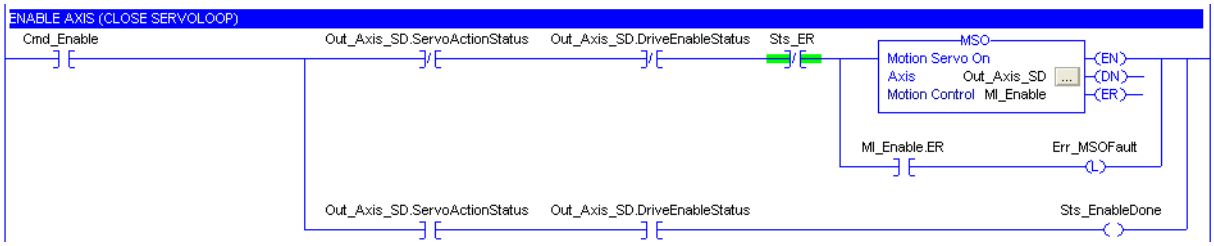
When an add-on instruction executes in Prescan mode, any required parameters have their data passed.

- Values are passed to input parameters from their arguments in the instruction call.
- Values are passed from output parameters to their arguments defined in the instruction call.

These values are passed even when the rung condition is false.

Cmd_Enable and Sts_EnableDone

When the command Cmd_Enable is set, it is checked to see if the axis is ready to execute the MSO instruction (feedback on). When Cmd_Enable is successfully executed, the Sts_EnableDone bit will be set.

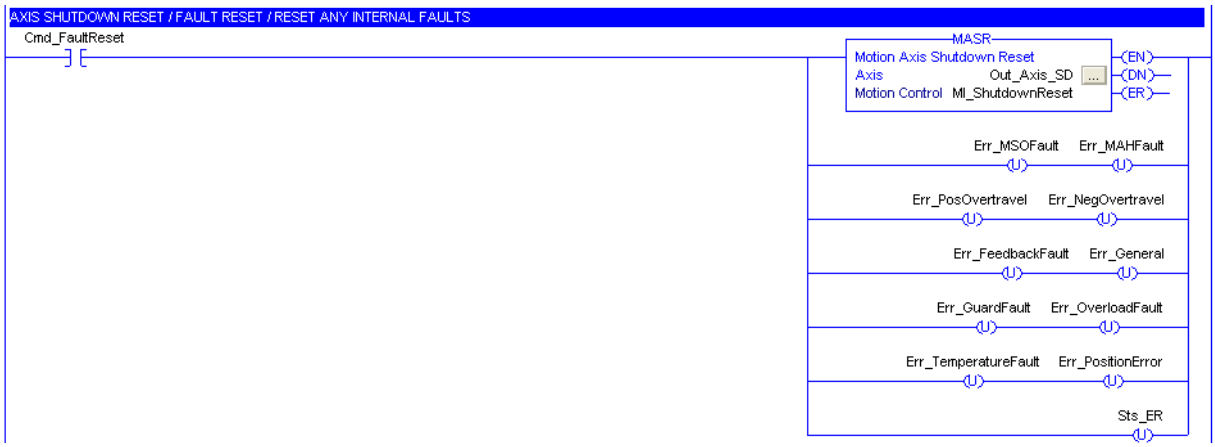


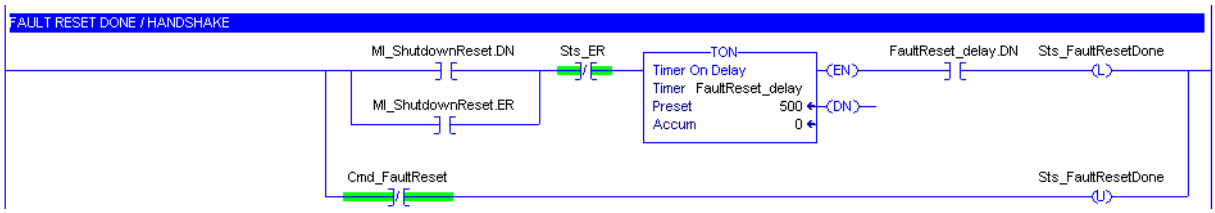
Cmd_Disable and Sts_DisableDone

When the command Cmd_Disable is set, it is checked to see if the axis is ready to execute the MSF instruction (feedback off). When Cmd_Disable is successfully executed, the Sts_DisableDone bit will be set.

Cmd_FaultReset and Sts_FaultResetDone

When the command Cmd_FaultReset is set, all Err-bits of the AOI are unlatched and the axis will be reset with a MASR instruction (Axis Shutdown Reset). When Cmd_FaultReset is successfully executed, the Sts_FaultResetDone bit will be set.





Cmd_Home, Sts_Homed and Sts_HomedDone

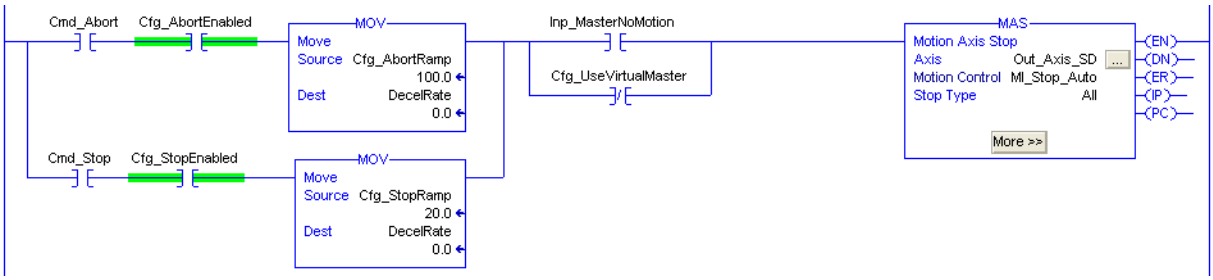
When the command Cmd_Home is set, a home sequence is initiated if the axis is configured to do a home. To configure the axis to home, the Cfg_HomeEnabled bit must be set.

Cfg_HomeEnabled	Behavior
0	Home instruction is not executed
1	CMD_Home will execute MAH instruction

When Cmd_Home is successfully executed, the Sts_Homed and Sts_HomeDone bits will be set.

Cmd_Abort/Sts_AbortDone and Cmd_Stop/Sts_StopDone

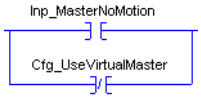
The two commands Cmd_Abort and Cmd_Stop initiate a stop of the axis.



If configured to do so, the command Cmd_Abort or Cmd_Stop will set a deceleration rate used by the MAS instruction (axis stop).

Cfg_AbortEnabled	Cfg_StopEnabled	Behavior
0	0	The axis does not execute the command
1	1	The axis executes the command

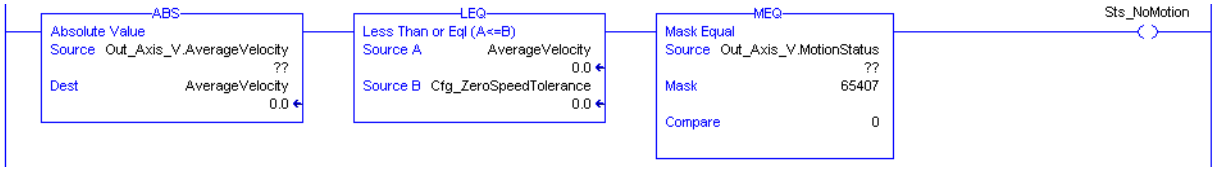
The axis can wait for the virtual master to be completely stopped before the MAS instruction is executed. If Cfg_UseVirtualMaster is set, abort will wait for Inp_MasterNoMotion before execution of the instruction. If not, it will be executed immediately..



Cfg_UseVirtualMaster	Behavior
0	Abort, Stop will execute the MAS instruction immediately
1	Abort, Stop will wait for Inp_MasterNoMotion before executing MAS instruction

When Sts_NoMotion of the axis is detected and either a Cmd_Abort or Cmd_Stop command is set, either the Sts_AbortDone or Sts_StopDone status bit, as appropriate, will be set.

'No motion' is when none of the motion planner inputs (for example, gears, jogs, or CAMs) are active and the axis speed is less than the level configured in Cfg_ZeroSpeedTolerance.



The motion planner inputs are masked with the MotionStatus (Motion planner input) set this way:

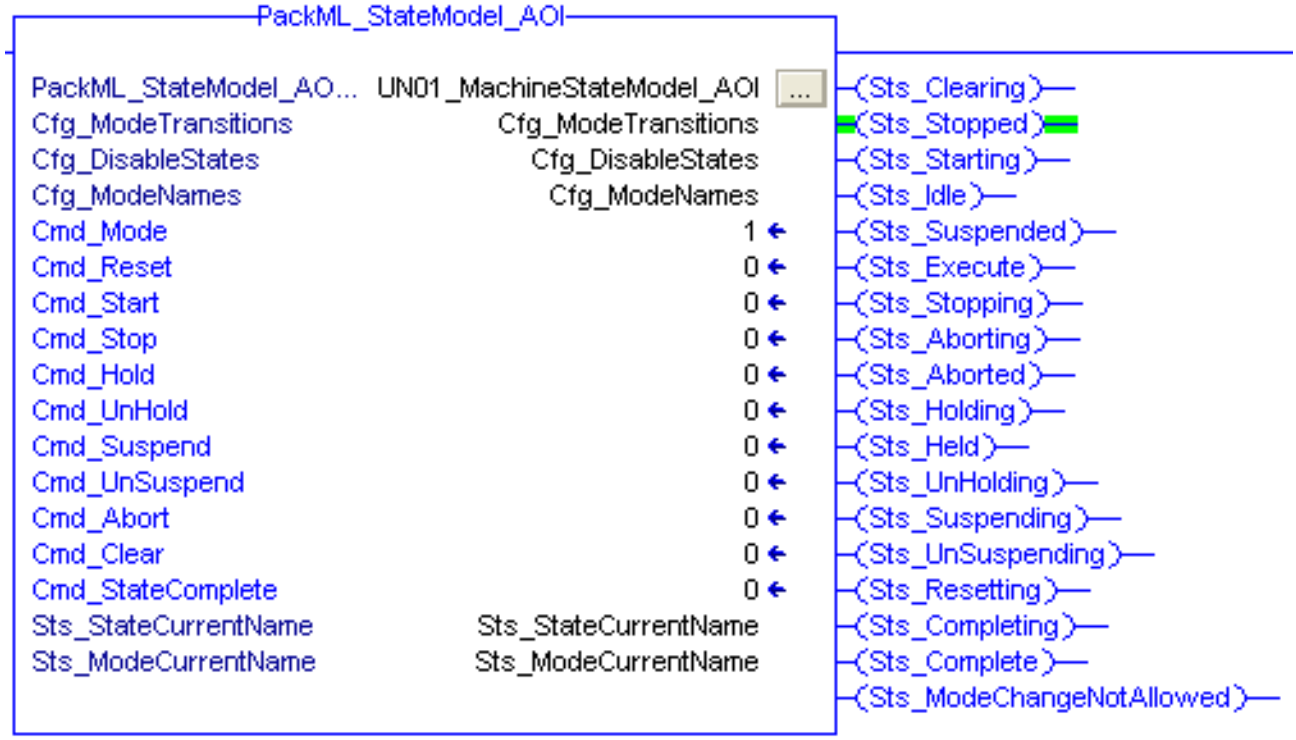
65407 [dec] = 1111 1111 0111 1111 [bin]

Bit	Description
00	AccelStatus
01	DecelStatus
02	MoveStatus
03	JogStatus
04	GearingStatus
05	HomingStatus
06	StoppingStatus
07	AxisHomedStatus
08	PositionCamStatus
09	TimeCamStatus
10	PositionCamPendingStatus
11	TimeCamPendingStatus
12	GearingLockStatus
13	PositionCamLockStatus
14	MasterOffsetMoveStatus
15	CoordinatedMotionStatus

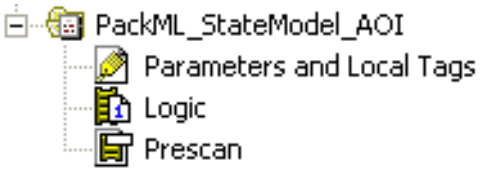
PackML_StateModel_AOI

The PackML_StateModel Add-On Instruction controls the use of the state machine defined by PackML.

Overview



The AOI consists of Parameters and Local Tags, and a routine for Logic and Prescan.

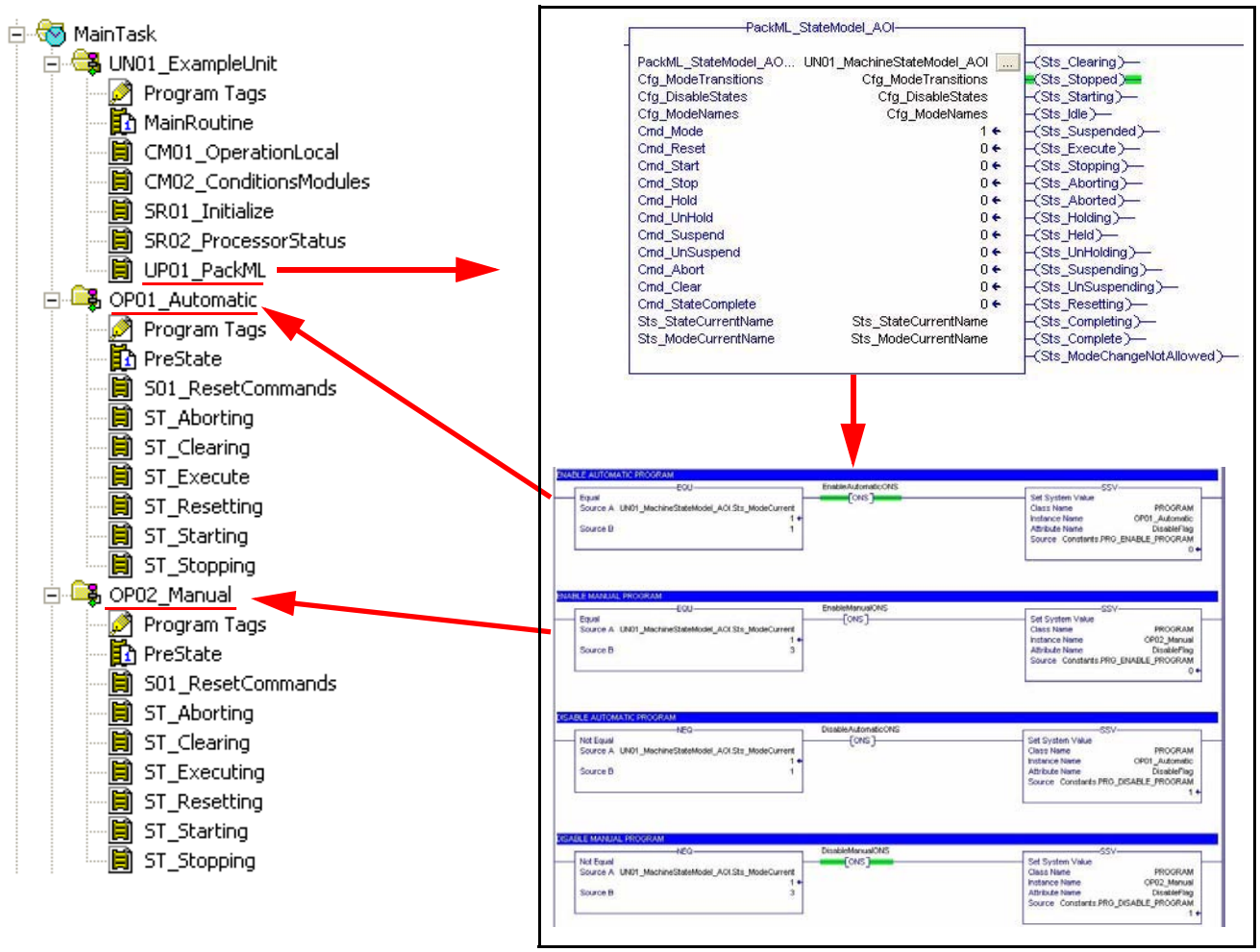


These configuration tags need to be configured for the AOI to work correctly:

- Cfg_ModeNames – See Cfg_ModeNames (Configure Mode Names)
- Cfg_ModeTransitions – See Cfg_ModeTransitions (Configure Mode Transitions)
- Cfg_DisableStates – See Cfg_DisableStates (Configure Disabling of States)

The AOI is used to call states in the modes (operations) that are defined. This template has two modes defined: Automatic and Manual. Each mode has an “operation program” OP01_Automatic and OP02_Manual where the execution of the states is carried out.

This AOI is called in the routine UP01_PackML where the current mode is also controlled. The graphic below illustrates this principle.



Based on the current mode (Sts_ModeCurrent), the phases will be inhibited and un-inhibited according to the mode.

The AOI also interfaces with the PackML state machine shown on the HMI.

Parameters and Local Tags

Only a few of the tags in the table below are visible on the AOI itself, and most of the other tags can be referenced via the backing tag outside the AOI. Local Tags can only be referenced inside the AOI, and are not discussed here.

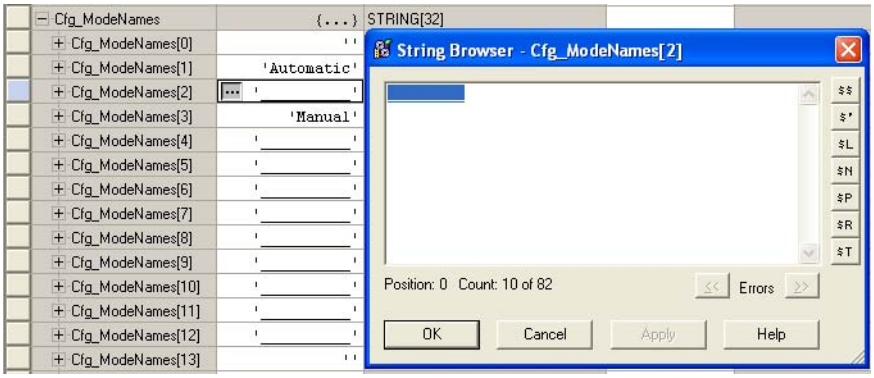
Below is a table with all tags that can be referenced outside the AOI.

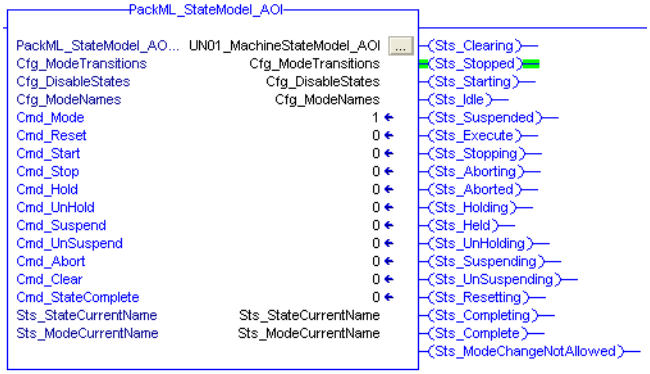
Name	Usage	Type	Description
Cfg_DisableStates	InOut	DINT[32]	Disable States for Different Modes
Cfg_ModeNames	InOut	STRING[32]	Mode Names
Cfg_ModeTransitions	InOut	DINT[32]	Acceptable States to Transition Between Modes
Cfg_RemoteCmdEnable	Input	BOOL	Enable Remote Commands
Cmd_Abort	Input	BOOL	PackML Abort Command
Cmd_Clear	Input	BOOL	PackML Clear Command
Cmd_Hold	Input	BOOL	PackML Hold Command
Cmd_Mode	Input	DINT	Commanded Mode
Cmd_Reset	Input	BOOL	PackML Reset Command
Cmd_Start	Input	BOOL	PackML Start Command
Cmd_StateComplete	Input	BOOL	PackML State Complete Command
Cmd_Stop	Input	BOOL	PackML Stop Command
Cmd_Suspend	Input	BOOL	PackML Suspend Command
Cmd_UnHold	Input	BOOL	PackML Unhold Command
Cmd_UnSuspend	Input	BOOL	PackML Unsuspend Command
EnableIn	Input	BOOL	Enable Input (System-defined parameter)
EnableOut	Output	BOOL	Enable Output (System-defined parameter)
Inp_RemoteModeCmd	Input	DINT	Mode Remote Command Interface
Inp_RemoteModeCmdChangeRequest	Input	BOOL	Mote Remote Command Change Request
Inp_RemoteStateCmd	Input	DINT	State Remote Command Interface
Inp_RemoteStateCmdChangeRequest	Input	BOOL	State Remote Command Change Request
Sts_Aborted	Output	BOOL	State Machine status is 'Aborted'

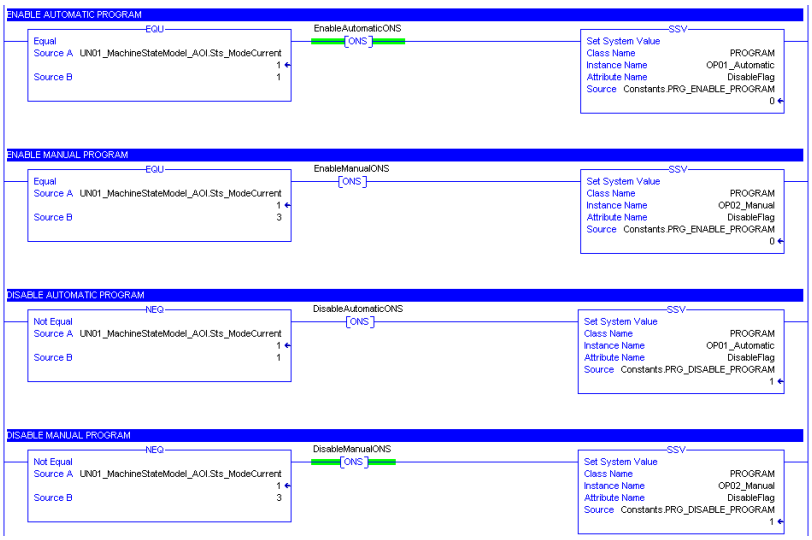
Sts_Aborting	Output	BOOL	State Machine status is 'Aborting'
Sts_Clearing	Output	BOOL	State Machine status is 'Clearing'
Sts_Complete	Output	BOOL	State Machine status is 'Complete'
Sts_Completing	Output	BOOL	State Machine status is 'Completing'
Sts_EnabledStates	Output	DINT	Currently Disabled States = 0
Sts_Execute	Output	BOOL	State Machine status is 'Execute'
Sts_Held	Output	BOOL	State Machine status is 'Held'
Sts_Holding	Output	BOOL	State Machine status is 'Holding'
Sts_Idle	Output	BOOL	State Machine status is 'Idle'
Sts_ModeChangeNotAllowed	Output	BOOL	Mode Change Request Was Denied
Sts_ModeCurrent	Output	DINT	Current Mode ID
Sts_ModeCurrentName	InOut	STRING	Current Mode Name
Sts_Resetting	Output	BOOL	State Machine status is 'Resetting'
Sts_Starting	Output	BOOL	State Machine status is 'Starting'
Sts_StateCurrent	Output	DINT	Current State ID
Sts_StateCurrentName	InOut	STRING	Current State Name
Sts_StateCurrentName	InOut	STRING	Current State Name
Sts_Stopped	Output	BOOL	State Machine status is 'Stopped'
Sts_Stopping	Output	BOOL	State Machine status is 'Stopping'
Sts_Suspended	Output	BOOL	State Machine status is 'Suspended'
Sts_Suspending	Output	BOOL	State Machine status is 'Suspending'
Sts_UnHolding	Output	BOOL	State Machine status is 'UnHolding'
Sts_UnSuspending	Output	BOOL	State Machine status is 'UnSuspending'

Cfg_ModeNames (Configure Mode Names)

The state machine can operate in various modes. Up to 31 different modes can be used (array index 1…31). Array number 0 (zero) is reserved and cannot be used. The template has two predefined modes, Automatic and Manual. Additional modes can easily be added.







Cfg_ModeTransitions (Configure Mode Transitions)

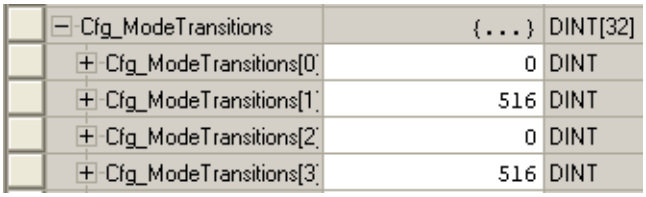
Cfg_ModeTransitions is used to define acceptable states to transition between modes. In this way you can allow a mode change, such as from Automatic mode to Manual mode, in the Execute state. The tag consists of an array of 32 DINT, each corresponding to one of the possible modes.

- Cfg_ModeName[1] = Cfg_ModeTransitions[1]
- Cfg_ModeName[2] = Cfg_ModeTransitions[2]
  …
- Cfg_ModeName[31] = Cfg_ModeTransitions[31]

Each individual bit of the DINT corresponds to a specific state as follows.

Bit	State Name
00	Not Used – Reserved
01	Clearing
02	Stopped
03	Starting
04	Idle
05	Suspended
06	Execute
07	Stopping
08	Aborting
09	Aborted
10	Holding
11	Held
12	Un-holding
13	Suspending
14	Un-Suspending
15	Resetting

Bit	State Name
16	Completing
17	Complete
18	Not Used – Reserved
19	Not Used – Reserved
20	Not Used – Reserved
21	Not Used – Reserved
22	Not Used – Reserved
23	Not Used – Reserved
24	Not Used – Reserved
25	Not Used – Reserved
26	Not Used – Reserved
27	Not Used – Reserved
28	Not Used – Reserved
29	Not Used – Reserved
30	Not Used – Reserved
31	Not Used – Reserved



The template has the following defined for both Automatic and Manual mode:

Cfg_ModeTransitions[1] = 516 [dec] = 0000 0000 0000 0000 0000 0010 0000 0100 [bin]

That means the template only allows a mode change in Stopped and Aborted state.

This AOI provides only a simple scheme of mode management such that a transition is allowed from the current mode to any other mode at any state that is configured for both the current and destination modes. There may be applications that will require that modes be separated into subsets that will allow modes within the subset to transition at a specific state but prohibit modes in separate subsets to transition at the same state.

For example, modes A, B, C, and D all have the Execute bit set in the Cfg_ModeTransitions array. The desire is for A and B to be able to transition in the Execute state and C and D to be able to transition in the Execute state; however, A and C, A and D, B and C, and B and D are not able to transition in the Execute state. There is no provision for this type of transition configuration built into the AOI, so it would be necessary to write logic outside of the AOI to enforce the rules in this example.

Cfg_DisableStates (Configure Disabling of States)

The template is very flexible and allows you to use only the states that are needed for a particular mode. The states that are not used will be jumped in the program and will not be visible on the state machine overview on the HMI application.

Certain states and state combinations are mandatory for any operation, and these are:

Mandatory states—AOI will reset the disable bits for these states automatically

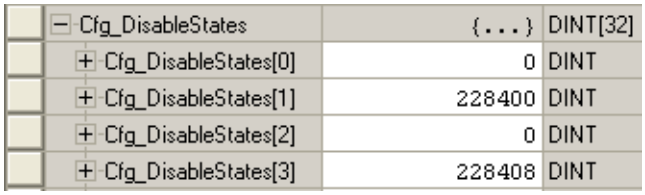
- Stopped
- Execute
- Aborted

Mandatory State combinations—AOI will reset the disable bits for these states automatically, if invalid state combination is detected

The above states are always mandatory and shall be set also if “none” is shown in this table.

State Used	Mandatory state to be automatically enabled, if the state is used
Resetting	None
Starting	None
Suspending	Suspended
UnSuspending	Suspended
Holding	Held
UnHolding	Held
Completing	Complete

State Used	Mandatory state to be automatically enabled, if the state is used
Aborting	None
Clearing	None
Idle	None
Held	None
Suspended	None
Complete	None
Stopped	None
Aborted	None
Execute	None



Each individual bit of the DINT corresponds to a specific state as follows.

Bit	State Name
00	Not Used – Reserved
01	Clearing
02	Stopped
03	Starting
04	Idle
05	Suspended
06	Execute
07	Stopping
08	Aborting
09	Aborted
10	Holding
11	Held
12	Un-holding

Bit	State Name
16	Completing
17	Complete
18	Not Used – Reserved
19	Not Used – Reserved
20	Not Used – Reserved
21	Not Used – Reserved
22	Not Used – Reserved
23	Not Used – Reserved
24	Not Used – Reserved
25	Not Used – Reserved
26	Not Used – Reserved
27	Not Used – Reserved
28	Not Used – Reserved

13	Suspending
14	Un-Suspending
15	Resetting

29	Not Used – Reserved
30	Not Used – Reserved
31	Not Used – Reserved

Automatic Mode

Cfg_DisableStates[1] = 228400 [dec] = 0000 0000 0000 0011 0111 1100 0011 0000 [bin]

That means the template disables the Idle, Suspended, Held, Un-Holding, Suspending, Un-Suspending, Completing, and Complete states.

Manual Mode

Cfg_DisableStates[3] = 228408 [dec] = 0000 0000 0000 0011 0111 1100 0011 1000 [bin]

That means the template disables the Starting, Idle, Suspended, Holding, Held, Un-holding, Suspending, Un-Suspending, Completing, and Complete states.

The configuration of the states of these operations may be altered, but disabling an acting state will result in the loss of those procedural steps. This could adversely affect the operation of this mode, and it may be necessary to move the logic from the disabled state to a state that is still enabled (i.e. Disabling the Clearing state of the Automatic Operation will result in not being able to clear faults on the Unit. It will be necessary to move that logic to another state such as Resetting.

Cfg_RemoteCmdEnable (Configure Remote Commands)

The AOI can be controlled via remote commands outside the unit (machine) such as with a line control (cell control).

Cfg_RemoteCmdEnable	Behavior
0	Remote command control is disabled
1	Remote command control is enabled

Cmd_*xx* (Commands)

The AOI makes use of the following commands that will request a state or mode change:

Cmd_Mode
Cmd_Reset
Cmd_Start
Cmd_Stop
Cmd_Hold
Cmd_UnHold
Cmd_Suspend
Cmd_UnSuspend
Cmd_Abort
Cmd_Clear
Cmd_StateComplete

All commands but two (Cmd_Mode and Cmd_Reset) have the same behavior. If Cmd_xx is set, the respective command is initiated if the actual state allows this command. According to PackML, the route in the state machine is dictated by the arrows. (See HMI - PackML State Machine on page 142 for state diagram.)

Cmd_Mode

Cmd_Mode (command mode) will request a mode change and will only be accepted according to the configuration of Cfg_ModeTransistions. (See Cfg_ModeTransitions (Configure Mode Transitions) on page 132.) Here it is defined if the individual states allow a change. If Cmd_Mode is set and the active state does not allow it, the Sts_ModeChangeNotAllowed status bit will be set.

Cmd_Reset

If Cmd_Reset (command reset) is set, a reset command is initiated. According to PackML, this command is used in either Complete or Stopped state to initiate a Resetting state. For a more intuitive mechanism, the template uses this command slightly differently, and will only allow this in Aborted. It will transition from Aborted to Clearing and is handled as a fault reset.

Inp_Remote*XX* (Input)

Remote control of mode and state commands is possible. Cfg_RemoteCmdEnable (Configure Remote Commands) on page 135 explains configuration of this option.

Remote Mode

Name	Usage	Type	Description
Inp_RemoteModeCmd	Input	DINT	Mode Remote Command Interface
Inp_RemoteModeCmdChangeRequest	Input	BOOL	Mote Remote Command Change Request

The local equivalent to Inp_RemoteModeCmd is Cmd_Mode, and its behavior is similar. (See Cmd_Mode on page 136.)

Inp_RemoteModeCmdChangeRequest is used to request a mode change – remote. There is no local equivalent to it.

Remote State

Name	Usage	Type	Description
Inp_RemoteStateCmd	Input	DINT	State Remote Command Interface
Inp_RemoteStateCmdChangeRequest	Input	BOOL	State Remote Command Change Request

The local equivalent to Inp_RemoteStateCmd is Cmd_XX (the individual commands), and the behavior is similar. (See Cmd_xx (Commands) on page 135.) The remote word is a DINT where the individual bits will correspond to a specific command.

Inp_RemoteStateCmdChangeRequest is used to request a state change – remote. There is no local equivalent to it.

Sts_*XX* (Status)

The AOI produces status for states and modes.

Status indicators for states

The AOI will produce an output status for each individual state. Only one of them can be set at any time, as it is the actual state of the state machine.

Sts_Aborted	Sts_Completing	Sts_Idle	Sts_Stopping
Sts_Aborting	Sts_Execute	Sts_Resetting	Sts_Suspended
Sts_Clearing	Sts_Held	Sts_Starting	Sts_Suspending
Sts_Complete	Sts_Holding	Sts_Stopped	Sts_UnHolding
Sts_UnSuspending			

Sts_EnabledStates	Currently Disabled States = 0
Sts_StateCurrent	Current State ID
Sts_StateCurrentName	Current State Name
Sts_StateCurrentName	Current State Name

Status indicators for modes

Sts_ModeChangeNotAllowed	Output	BOOL	Mode Change Request Was Denied
Sts_ModeCurrent	Output	DINT	Current Mode ID
Sts_ModeCurrentName	InOut	STRING	Current Mode Name

States - Descriptions

The PackML state machine consists of 17 states. The description and intention of each is listed below.

State Name	Description
STOPPED {Down}	State Type: Wait The machine is powered and stationary. All communications with other systems are functioning (if applicable).
STARTING {STARTUP}	State Type: Acting This state provides the steps needed to start the machine and is a result of a starting type command (local or remote). Following this command, the machine will begin to "execute".
IDLE [READY]	State Type: Wait This is a state which indicates that RESETING is complete. This state maintains the machine conditions which were achieved during the RESET state.
SUSPENDING	State Type: Acting This state is a result of a command change from the EXECUTE state. This state is typically required prior to the SUSPENDED wait state, and prepares the machine (for example, stops glue cycles, stops carton feeds, etc.) prior to the SUSPEND state.
SUSPENDED [RUNNING] {STANDBY}	State Type: Wait The machine may be running at the relevant setpoint speed, but there is no product being produced. This state can be reached as a result of a machine status, and differs from HELD in that HELD is typically a result of an operator request.
UN SUSPENDING	State Type: Acting This state is a result of a request from SUSPENDED state to go back to the EXECUTE state. The actions of this state may include: ramping up speeds, turning on vacuums, the re-engagement of clutches. This state is done prior to EXECUTE state, and prepares the machine for the EXECUTE state.
EXECUTE [PRODUCING] {RUN}	State Type: Dual State Once the machine is processing materials, it is deemed to be Executing or in the EXECUTE state. Execute refers to the mode in which the machine is in. If the machine is in the "Clean Out" mode, then "execute" refers to the action of cleaning the machine.
STOPPING {RUNOUT}	State Type: Acting This state executes the logic which brings the machine to a controlled and safe stop.
ABORTING	State Type: Acting The ABORTED state can be entered at any time in response to the Abort command or on the occurrence of a machine fault. The aborting logic will bring the machine to a rapid, controlled safe stop. Operation of the Emergency Stop will cause the machine to be tripped by its safety system. It will also provide a signal to initiate the ABORTING State.
ABORTED	State Type: Wait This state maintains machine status information relevant to the Abort condition. The Stop command will force transition to the Stopped state.

HOLDING	State Type: Acting When the machine is in the EXECUTE state, the Hold command can be used to start HOLDING logic which brings the machine to a controlled stop or to a state which represents HELD for the particular machine mode.
HELD	State Type: Wait The HELD state is typically be used by the operator to hold the machine's operation temporarily while material blockages are cleared, or to stop throughput while a downstream problem is resolved.
UNHOLDING	State Type: Acting UNHOLDING prepares the machine to re-enter the EXECUTE state. The UNHOLDING state is typically a response to an operator command to resume EXECUTE state.
COMPLETING	State Type: Acting This state is typically an automatic response from the EXECUTE state. Normal operation has run to completion, that is, processing of material at the infeed will stop.
COMPLETE	State Type: Wait The machine has finished the COMPLETING state and is now waiting for a STOP command that will cause a transition to the STOPPED state.
RESETTING	State Type: Acting This element is the result of a RESET command from the STOPPED state. RESETTING will typically cause a machine to sound a horn and place the machine in a state where components are energized awaiting a START command.
CLEARING	State Type: Acting The procedural element has received a command to clear faults that may have occurred when ABORTING, and are present in the ABORTED state before proceeding to a STOPPED state.

States - Transitions

The state transition signal is linked to the wait state. If the wait state is not enabled the state transition will be ignored. This means the statemachine does not wait for this signal but automatically moves to the next state.

State Used	**State Transition Required to get to next state (which ever the next state from the diagram is)**
Resetting	State Complete, Stop, Abort
Starting	State Complete, Stop, Abort
Suspending	State Complete, Stop, Abort
UnSuspending	State Complete, Stop, Abort
Holding	State Complete, Stop, Abort
UnHolding	State Complete, Stop, Abort
Completing	State Complete, Stop, Abort
Aborting	State Complete
Clearing	State Complete, Abort

State Used	State Transition Required to get to next state (which ever the next state from the diagram is)
Idle	Start, Stop, Abort
Held	Un-Hold, Stop, Abort
Suspended	Un-Suspend, Stop, Abort
Complete	Reset, Stop, Abort
Stopped	Reset, Abort
Aborted	Clear
Execute	Stop, Abort, Suspend, Hold, State Complete

If the next mandatory state is not available the command will be ignored.

For example, in execute:

if the state "Complete" is disabled and the signal "State Complete (SC)" is set the statemachine will stay in State Execute and ignore the signal.

Special case of Stopped, Resetting, Idle, Starting:

Following the above rules the behavior is the following:

Enabled States: Stopped, Resetting, Idle, Starting, Execute

State/Signal	Reset	Start	SC
Stopped	Resetting		
Resetting			Idle
Idle		Starting	
Starting			Execute

Enabled States: Stopped, Idle, Starting, Execute

State/Signal	Reset	Start	SC
Stopped	Idle		
Idle		Starting	
Starting			Execute

Enabled States: Stopped, Resetting, Starting, Execute

State/Signal	Reset	Start	SC
Stopped	Resetting		
Resetting			Starting
Starting			Execute

Enabled States: Stopped, Resetting, Idle, Execute

State/Signal	Reset	Start	SC
Stopped	Resetting		
Resetting			Idle
Starting		Execute	

Enabled States: Stopped, Starting, Execute

State/Signal	Reset	Start	SC
Stopped	Starting		
Starting			Execute

Enabled States: Stopped, Starting, Execute

State/Signal	Reset	Start	SC
Stopped	Resetting		
Starting			Execute

Enabled States: Stopped, Resetting, Idle, Execute

State/Signal	Reset	Start	SC
Stopped	Idle		
Idle		Starting	
Starting			Execute

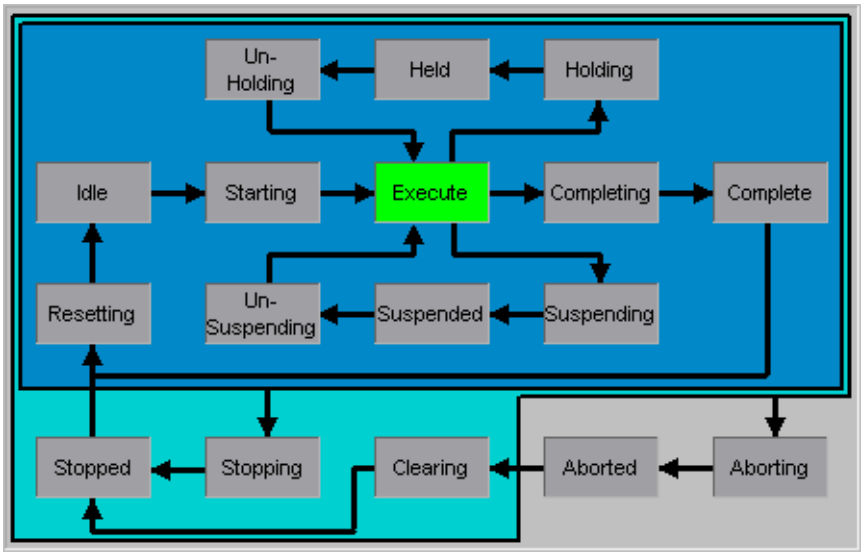
Enabled States: Stopped, Execute

State/Signal	Reset	Start	SC
Stopped	Execute		

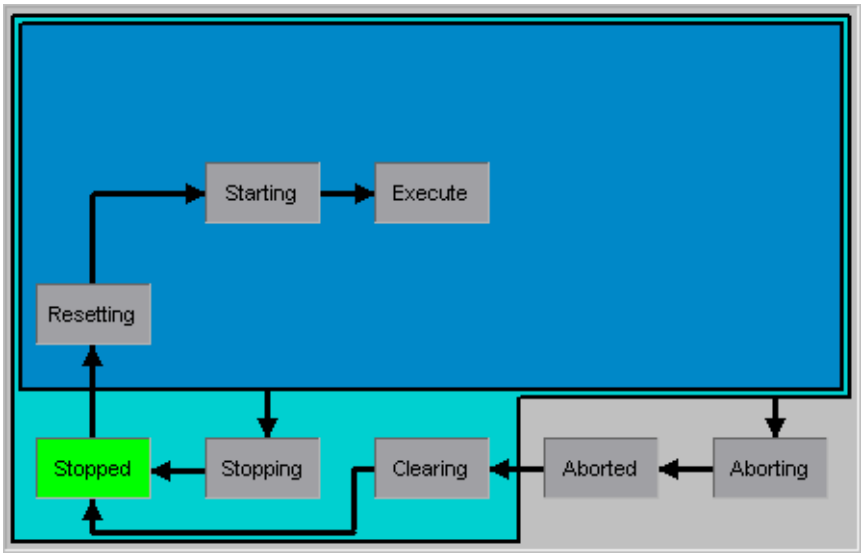
Not all states are configured in this template, but the AOI supports it. See Cfg_DisableStates (Configure Disabling of States) on page 133 for configuration.

HMI - PackML State Machine

The AOI comes with a face plate, where all states of the PackML state machine are shown. The active state is indicated with a green background. In the figure below, the Execute state is active.



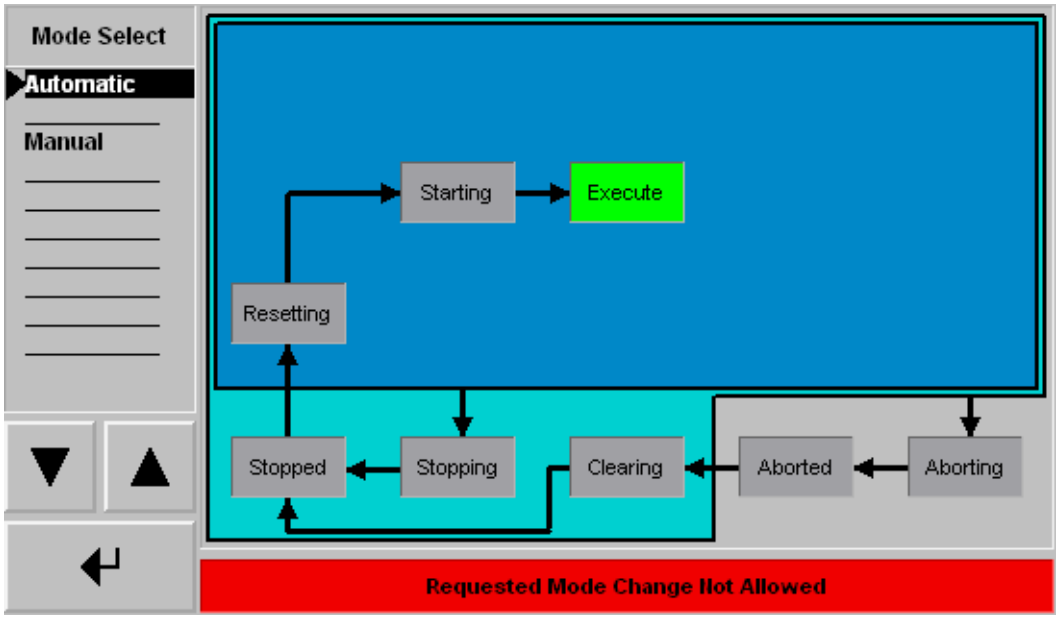
Only states that are not disabled will be shown. (See Cfg_DisableStates (Configure Disabling of States) on page 133 for configuration.) In this template, Automatic Mode will only show Aborting, Aborted, Clearing, Stopping, Stopped, Resetting, Starting, and Execute state.



Mode Selector

It is possible to change between the different modes that have been configured. (See Cfg_ModeNames (Configure Mode Names) on page 131 for configuration.) The template has two different modes: Automatic

and Manual. If you try to change mode in a state that does not allow a mode change, you will be notified by a red bar with the text: Requested Mode Change Not Allowed. This figure shows a request for Manual mode while the state machine is in Execute state.



Notes:

FactoryTalk View ME Communications Setup

This appendix shows you how to configure local communications for your Logix controller from FactoryTalk View Studio software. This procedure is necessary only if your controller is not available on the network.

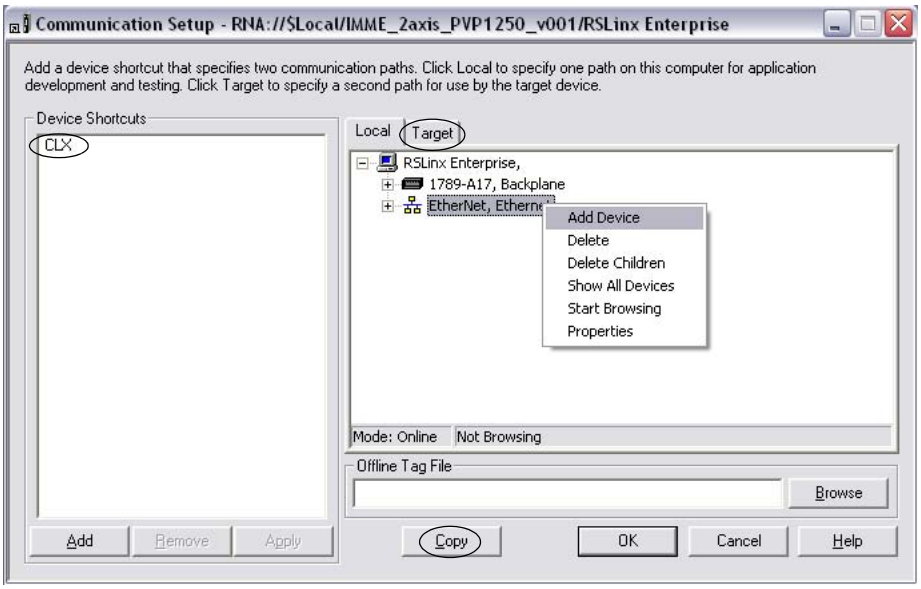
When finished with the local communications setup, use the same steps for manual configuration of target communications, or use the copy function to configure target communications as shown on page 63.

Configure Local Communications

Follow these steps to configure local communications.

1. Click the Local tab in the Communication Setup dialog box.

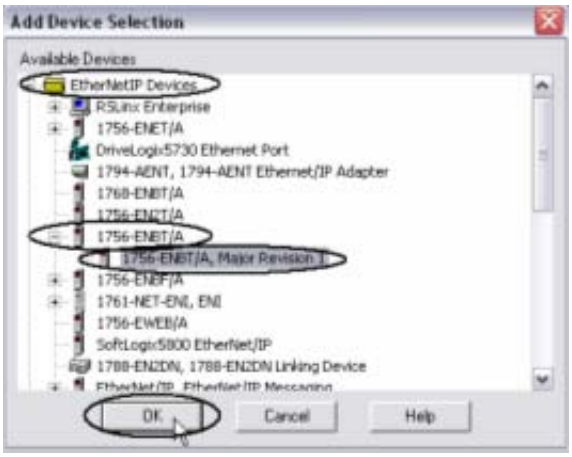
2. Right-click Ethernet, Ethernet and choose Add Device.



The Add Device Selection window opens.

3. Expand the EtherNetIP Devices tree to gain access to the 1756-ENBT/A module.

In this example, 1756-ENBT/A is the Ethernet module. Yours could be different.



4. Expand 1756-ENBT/A and select the 1756-ENBT/A, Major Revision 1 module.

5. Click OK.

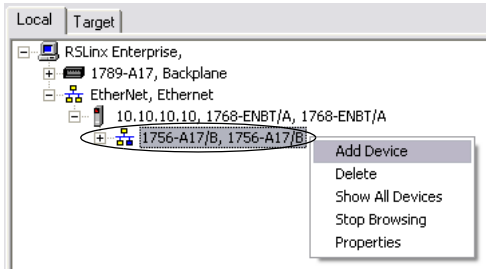
The Device Properties dialog box opens.

6. Type the IP address of the ControlLogix controller.

7. Click OK.

8. Return to the Communications Setup window, Local tab, and expand IP Address, 1756-ENBT/A.

9. Right-click 1756-A17/B, 1756-A17/B and choose Add Device. Yours could be different.

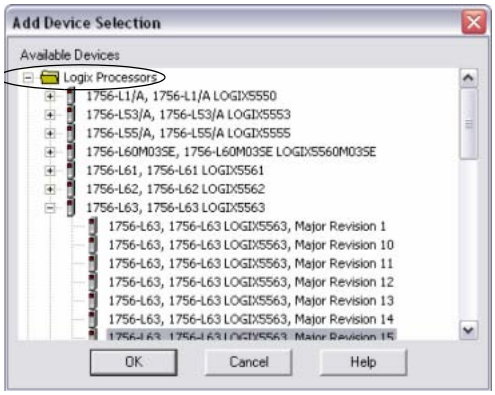


The Add Device Selection dialog box opens.

10. Expand Logix Processors to gain access to the 1756-L63 controller.

11. Select Major Revision 15 (or later).

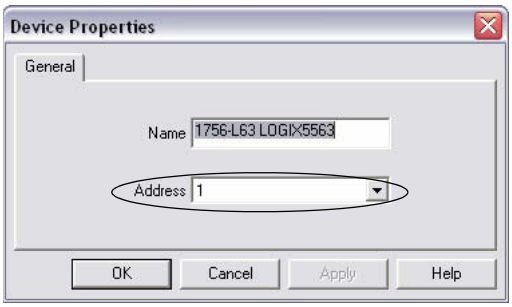
12. Click OK.



The Device Properties dialog box opens.

13. Set the L63 controller address to 1 (slot number of the chassis).

14. Click OK.



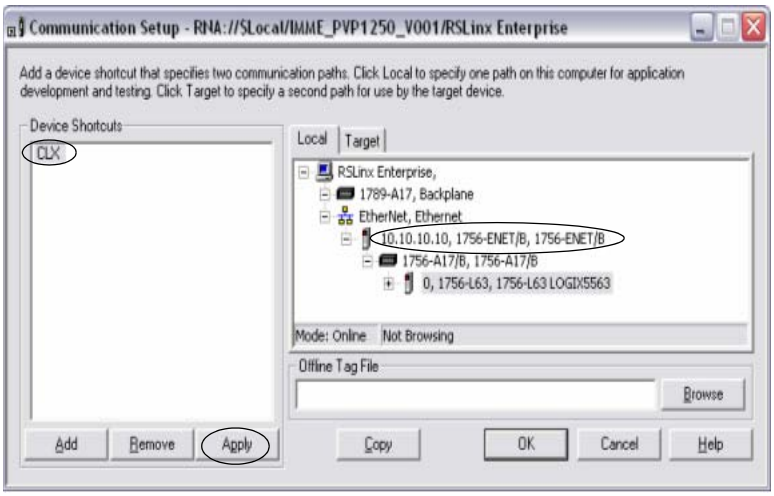
Return to the Communication Setup window.

15. Select CLX in the Device Shortcuts window

16. Select 0, 1756-L63, the ControlLogix controller.

17. Click Apply in the Device Shortcuts pane.

18. Click OK.



TIP If you select the device shortcut (CLX), the 1756-L63 ControlLogix process is highlighted. This indicates that the shortcut is correctly mapped to the controller, and communication exists between your application on the development computer and the controller.

Notes:

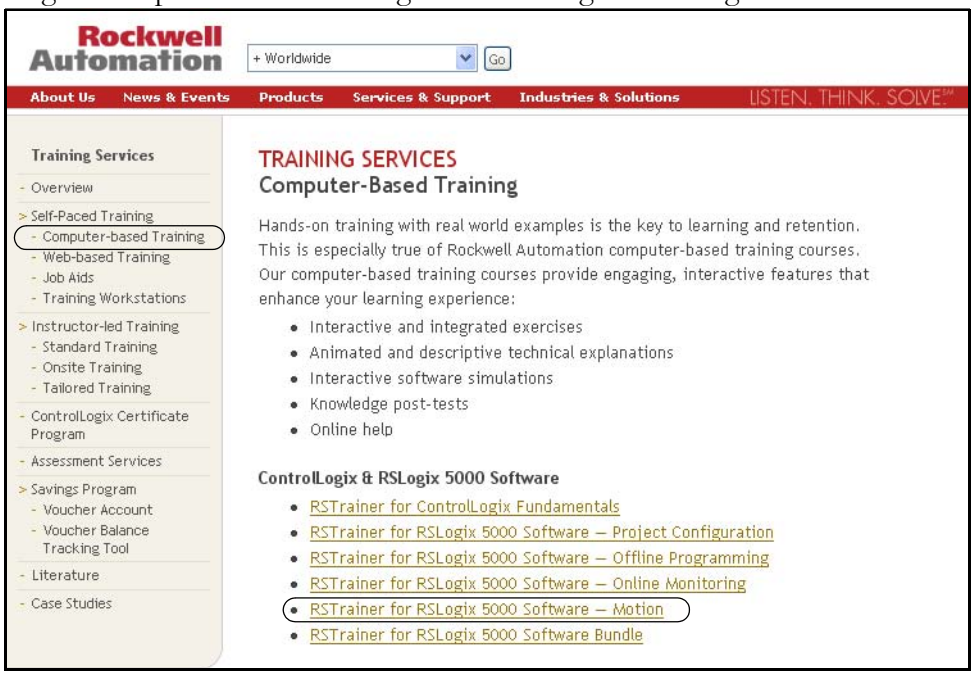
Rockwell Automation Training Services

Available Training

Contact your Allen-Bradley distributor or local Rockwell Automation sales office, or visit the Rockwell Automation Training Services website for a complete list of training opportunities. The following types of training are available.

- Computer-based and Web-based training that you complete at your own pace
- Job aids and training workstations
- Instructor-led training through our standard open enrollment or on site at your facility and tailored to suit your needs

RSTrainer for RSLogix Software - Motion, course 9393-RSTLX5KMOT is available from the Rockwell Automation Training Services website at http://www.rockwellautomation.com/services/training > Self-paced Training > Computer-based Training > ControlLogix & RSLogix 5000 Software.



Notes:

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Location/Phone _____

Would you like us to contact you regarding your comments?

___No, there is no need to contact me

___Yes, please call me

___Yes, please email me at _____

___Yes, please contact me via _____

Return this form to: Rockwell Automation Technical Communications, 1 Allen-Bradley Dr., Mayfield Hts., OH 44124-9705

Fax: 440-646-3525 Email: RADocumentComments@ra.rockwell.com

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Rockwell Automation

1 ALLEN-BRADLEY DR
MAYFIELD HEIGHTS OH 44124-9705

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running.

United States	1.440.646.3434 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning, it may need to be returned.

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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